OCS EIS/EA
BOEM 2016-001

Outer Continental Shelf
Oil and Gas Leasing Program: 2017-2022

Draft Programmatic Environmental Impact Statement

March 2016

Volume II: Appendices

U.S. Department of the Interior
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COVER SHEET

Programmatic Environmental Impact Statement
for
Outer Continental Shelf Oil and Gas Leasing Program: 2017-2022

Draft (x) **Final ( )**

Type of Action: Administrative (x) Legislative ( )

Area of Potential Impact: Offshore Marine Environment and Coastal States of Alaska, Virginia, North Carolina, South Carolina, Georgia, Texas, Louisiana, Mississippi, and Alabama

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ABSTRACT

This Programmatic Environmental Impact Statement (EIS) addresses the 2017-2022 Outer Continental Shelf (OCS) Oil and Gas Leasing Program, published as a Draft Proposed Program (DPP) in January 2015 (USDOI, BOEM, 2015).

The Proposed Action is considered to be a major federal action with potential national implications, and the Programmatic EIS will be used to inform decisions on the 2017-2022 oil and gas program proposal. In accordance with the National Environmental Policy Act (NEPA) and its implementing regulations; the Programmatic EIS addresses the purpose of and need for action; identifies alternatives and their screening; describes the affected environment; and analyzes the potential environmental impacts of the Proposed Action, alternatives, and expected and potential mitigation. Potential contributions to cumulative impacts resulting from activities associated with the Proposed Action are also analyzed. Hypothetical scenarios were developed for the Proposed Action to help depict the levels of activities, number and size of accidental events (such as oil spills), and focus analyses of potential impacts that might result.

This Programmatic EIS explores alternatives and discloses potential environmental effects of oil and natural gas leasing, exploration, development, and production in the OCS areas selected in the DPP in addition to analyzing the potential impacts on coastal environments, offshore marine resources, and socioeconomic resources. This Programmatic EIS was prepared using the best scientific information publicly available at the time of preparation. Where relevant information on reasonably foreseeable significant adverse impacts was incomplete or unavailable, the need for the information was evaluated to determine if it was essential to making a reasoned choice among the alternatives and, if so, that it was either acquired or accepted scientific methodologies were applied in its place in the event it was impossible or exorbitant to acquire.

Additional copies of this Programmatic EIS may be obtained from the Bureau of Ocean Energy Management, Attn: Dr. Jill Lewandowski, by telephone at 703-787-1703, or it can be downloaded from the website http://www.boemoceaninfo.com.

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LIST OF ACRONYMS

2D	two-demensional
3D	three-dimensional
Ac	acre
ACHP	Advisory Council on Historic Preservation
ACP	Alaska Coastal Plain
ACS	American Community Survey
ADEC	Alaska Department of Environmental Conservation
ADF&G	Alaska Department of Fish and Game
ADFG	Alaska Department of Fish and Game
ADLWD	Alaska Department of Labor and Workforce Development
ADNR	Alaska Department of Natural Resources
AFB	Air Force Base
AFPM	American Fuel and Petrochemical Manufacturers
AHTS	anchor handling towing supply
AMAP	Arctic Monitoring Assessment Program
AMOC	Atlantic Meridional Overturning Circulation
ANCSA	Alaska Native Claims Settlement Act
ANILCA	Alaska National Interest Land Conservation Act
ASAMM	Aerial Surveys of Arctic Marine Mammals
ASD	Alaska School District
ASFPM	Association of State Floodplain Managers
BA	Biological Assessment
bbl	barrels of oil
Bbbl	billion barrels of oil
bcf	billion cubic feet
BCRs	bird conservation regions
BIA	Biologically Important Area
BLM	Bureau of Land Management
BO	Biological Opinion
BOE	barrel of oil equivalent
BOEM	Bureau of Ocean Energy Management
BOEM OPA	BOEM's Office of Public Affairs
BOEMRE	Bureau of Ocean Energy, Management, Regulation and Enforcement
BOP	blowout preventer
Bpd	barrels per day
BSEE	Bureau of Safety and Environmental Enforcement
CAA	Clean Air Act
CATEX	categorical exclusion
CDE	catastrophic discharge event
CEI	Coastal Environments, Inc.
CEQ	Council on Environmental Quality
CETAP	Cetacean and Turtle Assessment Program
CFR	Code of Federal Regulations

LIST OF ACRONYMS
(Continued)

CH4	methane
CHSRA	Cape Hatteras Special Research Area
CI	confidence interval
CMSP	Coastal and Marine Spatial Planning
CO	carbon monoxide
CO_2	carbon dioxide
CO2e	carbon dioxide equivalent
COST	continental offshore strategic test
CPRA	Coastal Protection and Restoration Authority
CV	coefficient variation
CW	continuous wave
CWA	Clean Water Act
CZ	Convergence Zone
CZM	Coastal Zone Management
CZMA	Coastal Zone Management Act
DECC	Department of Energy and Climate Change
DNR	Department of Natural Resources
DP	dynamic positioning
DPP	Draft Proposed Program
DPS	Distinct Population Segment
E	endangered
E&D	Exploration and development
EA	Environmental Assessment
EEZ	Exclusive Economic Zone
EFH	Essential Fish Habitat
Eh	oxidation reduction potential
EIA	Environmentally Important Area
EIS	Environmental Impact Statement
EO	Executive Order
EP	Exploration Plan
EPAct	Energy Policy Act of 2005
ESA	Endangered Species Act
ESI	Environmental Sensitivity Index
FAA	Federal Aviation Administration
FCMA	Magnuson-Stevens Fishery Conservation and Management Act
FDEP	Florida Department of Environmental Protection
FKNMS	Florida Keys National Marine Sanctuary
FMC	Fisheries Management Council
FMP	Fisheries Management Plan
FONSI	Finding of No Significant Impact
FPSO	floating production, storage, and offloading

LIST OF ACRONYMS
(Continued)

ft	feet
FWC	Florida Fish and Wildlife Conservations Commission
FWCA	Fish and Wildlife Coordination Act
FWPCA	Federal Water Pollution Control Act
GAO	General Accounting Office
G&G	geological and geophysical
GDP	Gross Domestic Product
GHG	greenhouse gas
GIS	Geographic Information System
GMFMC	Gulf of Mexico Fishery Management Council
GNOR	Greater New Orleans Region
GOA	Gulf of Alaska
GOADS	Gulfwide Offshore Activity Data System
GRT	gross register tonnage
GSFC	Goddard Space Flight Center
HAPC	Habitat Areas of Particular Concern
HCA	Habitat Conservation Area
Hertz	Hz
HFCs	hydrofluorocarbons
HMS	Highly Migratory Species
HPA	Habitat Protection Area
HSSE	health, safety, security, and environment
HSWUA	Hanna Shoal Walrus Use Area
IBA	Important Bird Area
IHA	incidental harassment authorization
IPCC	International Panel on Climate Change
IPF	impact-producing factor
ITL	Information to Lessees
ITS	incidental take statement
JBER	Joint Base Elmendorf-Richardson
kn	knot
KPB	Kenai Peninsula Borough
lbs	pound
LCI	Lower Cook Inlet
LME	large marine ecosystems
LNG	liquefied natural gas
LOA	letters of authorization
LOOP	Louisiana Offshore Oil Port

LIST OF ACRONYMS
(Continued)

LRRS	Long-Range Radar Sites
MAB	Mid-Atlantic Bight
MAFMC	Mid-Atlantic Fisheries Management Council
MARPOL	International Convention of the Prevention of Pollution from Ships
MARS	Mid-Atlantic Regional Spaceport
Mat-Su	Matanuska-Susitna
MBAC	Microbiome Analysis Center
MBTA	Migratory Bird Treaty Act
MCBI	Marine Conservation Biology Institute
mcf	million cubic feet
MESA	most environmentally significant area
μPa	micropascals
μs	microseconds
MMbl	million barrels of oil
MMBOE	million barrels of oil equivalent
MMPA	Marine Mammal Protection Act
MMS	Minerals Management Service
MoA	Municipality of Anchorage
MODUs	mobile offshore drilling units
MOU	Memorandum of Understanding
MPA	Marine Protected Areas
MPPRCA	Marine Plastic Pollution Research and Control Act
MPRSA	Marine Protection, Research, and Sanctuaries Act
MRIP	Marine Recreational Information Program
ms	milliseconds
MUA	Municipal Utility Authority
N_20	nitrous oxide
NAA	No Action Alternative
NAAQS	National Ambient Air Quality Standards
NABCI	North American Bird Conservation Initiative
NARW	North Atlantic right whale
NASA	National Aeronautics and Space Administration
NASA	National Aeronautics and Space Administration
NAST	National Assessment Synthesis Team
NCA	National Coastal Assessment
NCDOT	North Carolina Department of Transportation
NEFMC	New England Fishery Management Council
NEP	National Estuary Program
NEPA	National Environmental Policy Act
NERR	National Estuarine Research Reserves
NEV	net economic value

LIST OF ACRONYMS
(Continued)

NGO	non-government organization
NHPA	National Historic Preservation Act
NIC	National Incident Command
NIT	Norfolk International Terminals
NMFS	National Marine Fisheries Service
NMS	National Marine Sanctuary
NMSA	National Marine Sanctuary Act
NO_2	nitrous dioxide
NO_x	nitrogen oxides
NOA	Notice of Availability
NOAA	National Oceanic and Atmospheric Administration
NOI	Notice of Intent
NORM	naturally occurring radioactive material
NOS	National Ocean Service
NPDES	National Pollution Elimination System
NPFMC	North Pacific Fisheries Management Council
NPP	National Park and Preserve
NPR-A	National Petroleum Reserve - Alaska
NPS	National Park Service
NRC	National Research Council
NRDC	National Resources Defense Council
NSB	North Slope Borough
NSIDC	National Snow and Ice Data Center
NTEL	National Energy Technology Laboratory
NTL	Notice to Lessee and Operators
NWAB	Northwest Arctic Borough
NWP	Nationwide Permit
NWR	National Wildlife Refuge
O_3	ozone
OCD	Offshore and Coast Dispersion
OCM	Office for Coastal Management
OCS	Outer Continental Shelf
OCSLA	Outer Continental Shelf Lands Act
ODMDS	offshore dredged material disposal site
OECM	Offshore Environmental Cost Model
ONMS	Office of National Marine Sanctuaries
OPA	Oil Pollution Act
OPAREAs	Operating Areas
ORPC	Ocean Renewable Power Company
ORR	Office of Resource Restoration
OSAT	Operational Science Advisory Team
OSFR	oil-spill financial responsibility

LIST OF ACRONYMS
(Continued)

OSPAR Convention	Convention for the Protection of the Marine Environment of the North-East Atlantic
OSV	offshore support vessel
P	pressure
PAHs	polycyclic aromatic hydrocarbons
Pb	lead
PCBs	polychlorinated biphenyls
PE	Parabolic Equation
PFCs	perfluorocarbons
pH	potential of hydrogen
PINS	Padre Island National Seashore
PM	particulate matter
PM_{10}	course particulate matter
$PM_{2.5}$	fine particulate matter
PP	Proposed Program
Programmatic EIS	Programmatic Environmental Impact Statement
PSD	Prevention of Significant Deterioration
PSOs	Protected Species Observers
PTS	Permanent threshold shift
RCRA	Resource Conservation and Recovery Act
RD	Regional Director
RHA	Rivers and Harbors Act
RMS	root-mean-squared
s	seconds
SAB	South Atlantic Bight
SAFMC	South Atlantic Fishery Management Council
SBM	synthetic-based muds
SCDNR	South Carolina Department of Natural Resources
SEL	sound exposure level
SFA	Sustainable Fisheries Act
SI	International System of Units
SLR	sea level rise
SO_2	sulfur dioxide
SO_x	sulfur oxides
SPL	Sound Pressure Level
SST	sea surface temperature
SVP	sound velocity profiles
T	threatened
TAPS	Trans-Alaska Pipeline System
TATEC	Turnagain Arm Tidal Energy Corporation

LIST OF ACRONYMS
(Continued)

tcf	trillion cubic feet
TL	transmission loss
TLP	Tension leg platform
TOC	total organic carbon
TTS	Temporary threshold shift
UME	unusual mortality event
UCI	Upper Cook Inlet
USACE	U.S. Army Corps of Engineers
USCG	U.S. Coast Guard
USDOC	U.S. Department of Commerce
USDOD	U.S. Department of Defense
USDOI	U.S. Department of the Interior
USDOT, FAA	U.S. Department of Transportation, Federal Aviation Administration
USEIA	U.S. Energy Information Administration
USEPA	U.S. Environmental Protection Agency
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
VACAPES	Virginia Capes
VOCs	volatile organic compounds
VPA	Virginia Port Authority
WBM	water-based muds
WEA	wind energy area
WEA	wind energy area
WFF	Wallops Flight Facility
WHSRN	Western Hemisphere Shorebird Reserve Network

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Appendix A

Glossary

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anadromous fish – fish that migrate up river from the sea to breed in fresh water.

anthropogenic – coming from human sources, relating to the effect of man on nature.

archaeological interest – capable of providing scientific or humanistic understanding of past human behavior, cultural adaptation, and related topics through the application of scientific or scholarly techniques, such as controlled observation, contextual measurement, controlled collection, analysis, interpretation, and explanation.

archaeological resource – any material remains of human life or activities that are at least 50 years of age and that are of archaeological interest.

aromatic – applied to a class of organic compounds containing benzene rings or benzenoid structures.

attainment area – an area that is classified by the U.S. Environmental Protection Agency (USEPA) as meeting the primary or secondary ambient air quality standards for a particular air pollutant based on monitored data.

barrel – equal to 42 U.S. gallons or 158.99 liters.

benthic – bottom dwelling, associated with (in or on) the seafloor.

benthos – organisms that dwell in or on the seafloor, the organisms living in or associated with the benthic (or bottom) environment.

biological opinion – an appraisal from either the U.S. Fish and Wildlife Service (USFWS) or the National Marine Fisheries Service (NMFS) evaluating the impact of a proposed federal action, if it is likely to jeopardize the continued existence of a listed species or result in the destruction or adverse modification of critical habitat, as required by Section 7 of the Endangered Species Act.

bivalves – general term for two-shelled mollusks (clams, oysters, scallops, mussels).

cetacean – any of an order (Cetacea) of aquatic mostly marine mammals including the whales, dolphins, porpoises, and related forms with a large head, fusiform, nearly hairless body, paddle-shaped forelimbs, vestigial concealed hind limbs, and horizontal flukes (tails).

chemosynthetic – organisms that obtain their energy from the oxidation of various inorganic compounds rather than from light (photosynthesis).

coastal wetlands – forested and nonforested habitats, mangroves, and all marsh islands that are exposed to coastal waters. Included in forested wetlands are hardwood hammocks, cypress swamps, and fluvial vegetation/bottomland hardwoods. Nonforested wetlands include fresh, brackish, and salt marshes. These areas directly contribute to the high biological productivity of coastal water by input of detritus and nutrients, by providing nursery and feeding areas for shellfish and finfish, by serving as habitat for many birds and other animals, and by providing for waterfowl hunting and fur trapping.

coastal zone – the coastal waters (including the lands therein and thereunder) and the adjacent shore lands (including the waters therein and thereunder) strongly influenced by each other and in proximity to the shorelines of the several coastal states; and including islands, transitional and intertidal areas, salt marshes, wetlands, and beaches. The zone extends seaward to the outer limit of the United States territorial sea. The zone extends inland from the shorelines only the extent necessary to control shore lands, the uses of which have a direct and significant impact on the coastal waters. Excluded from the coastal zone are lands the use of which are by law subject to the discretion of or which are held in trust by the Federal Government, its officers, or agents. (The state land and water area officially designated by the state as "coastal zone" in its state coastal zone program as approved by the U.S. Department of Commerce under the Coastal Zone Management Act [CZMA].)

coastal zone consistency review – State review of direct federal activities or private individual activities requiring federal licenses or permits, and outer continental shelf (OCS) plans pursuant to the CZMA to determine if the activity is consistent with the enforceable policies of the state's federally approved Coastal Zone Management (CZM) Program.

continental shelf – a broad, gently sloping, shallow feature extending from the shore to the continental slope, generally considered to exist to the depth of 200 m (656 ft).

continental slope – a relatively steep, narrow feature paralleling the continental shelf; the region in which the steepest descent to the ocean bottom occurs; that part of the continental margin between the continental shelf and the continental rise (or oceanic trench).

contingency plan – a plan for possible offshore emergencies prepared and submitted by the oil or gas operator as part of the plan of development and production, and which may be required for part of the plan of exploration.

critical habitat – a designated area that is essential to the conservation of an endangered or threatened species that may require special management considerations or protection.

crude oil – petroleum in its natural state as it emerges from a well, or after it passes through a gas-oil separator but before refining or distillation.

crustaceans – any of a large class (Crustacea) of mostly aquatic mandibulate arthropods that have a chitinous or calcareous and chitinous exoskeleton, a pair of often much modified appendages on each segment, and two pairs of antennae and that include the lobsters, shrimps, crabs, wood lice, water fleas, and barnacles.

delineation well – an exploratory well drilled to define the areal extent of a field. Also referred to as an "expendable well."

development – activities that take place following discovery of minerals in paying quantities, including geophysical activity, drilling, platform construction, and operation of all shore base facilities, and that are for the purpose of ultimately producing the minerals discovered.

development and production plan – a plan describing the specific work to be performed on an offshore lease, including all development and production activities that the lessee proposes to undertake during the time period covered by the plan and all actions to be undertaken up to and including the commencement of sustained production. The plan also includes descriptions of facilities and operations to be used, well locations, current geological and geophysical information, environmental safeguards, safety standards and features, time schedules, and other relevant information. All lease operators are required to formulate and obtain approval of such plans by the Bureau of Ocean Energy Management (BOEM) before development and production activities may begin; requirements for submittal of DPP are wholly identified in 30 CFR 250.34.

development well – a well drilled into a known producing formation in a previously discovered field, to be distinguished from a wildcat, exploratory, or offset well.

dilution – the reduction in the concentration of dissolved or suspended substances by mixing with water.

discharge – something that is emitted; flow rate of a fluid at a given instant expressed as volume per unit of time.

dispersion – a distribution of finely divided particles in a medium.

drillship – a self-propelled, self-contained vessel equipped with a derrick amidships for drilling wells in deep water.

drilling mud – a special mixture of clay, water, or refined oil, and chemical additives pumped downhole through the drill pipe and drill bit. The mud cools the rapidly rotating bit, lubricates the drill pipe as it turns in the wellbore, carries rock cuttings to the surface, serves to keep the hole from crumbling or collapsing, and provides the weight or hydrostatic head to prevent extraneous fluids from entering the wellbore and to control downhole pressures that may be encountered (drilling fluid).

effluent – the liquid waste of sewage and industrial processing.

endangered species – any species that is in danger of extinction throughout all or a significant portion of its range and has been officially listed by the appropriate federal or state agency; a species is determined to be endangered because of any of the following factors: (1) the present or threatened destruction, modification, or curtailment of its habitat or range; (2) overutilization for commercial, sporting, scientific, or educational purposes; (3) disease or predation; (4) the inadequacy of existing regulatory mechanisms; or (5) other natural or man-made factors affecting its continued existence.

environmental assessment (EA) – a concise public document required by the National Environmental Policy Act of 1969 (NEPA). In the document, a federal agency proposing (or reviewing) an action provides evidence and analysis for determining whether it must prepare an environmental impact statement (EIS) or whether it finds there is no significant impact (i.e., Finding of No Significant Impact [FONSI]).

environmental effect – a measurable alteration or change in environmental conditions.

environmental impact statement (EIS) – a statement required by the NEPA or similar state law in relation to any major action significantly affecting the environment; a NEPA document.

essential habitat – specific areas crucial to the conservation of a species that may necessitate special considerations.

essential fish habitat (EFH) – those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity. This includes areas that are currently or historically used by fish, or that have substrate such as sediment, hard bottom, bottom structures, or associated biological communities required to support a sustainable fishery.

estuary – semi-enclosed coastal body of water that has a free connection with the open sea and within which seawater is measurably diluted with freshwater.

exclusion – action taken by the Secretary of the Interior to remove certain areas/blocks from a lease offering**.**

exclusive economic zone (EEZ) – the maritime region adjacent to the territorial sea, extending 200 nautical miles (nmi) from the baseline of the territorial sea, in which the United States has exclusive rights and jurisdiction over living and nonliving natural resources.

exploration – the process of searching for minerals. Exploration activities include: (1) geophysical surveys where magnetic, gravity, seismic, or other systems are used to detect or infer the presence of such minerals; and (2) any drilling, except development drilling, whether on or off known geological structures. Exploration also includes the drilling of a well in which a discovery of oil or natural gas in paying quantities is made, and the drilling, after such a discovery, of any additional well that is needed to delineate a reservoir and to enable the lessee to determine whether to proceed with development and production.

exploration plan (EP) – a plan submitted by a lessee (30 CFR 250.33) that identifies all the potential hydrocarbon accumulations and wells that the lessee proposes to drill to evaluate the accumulations within the lease or unit area covered by the plan. All lease operators are required to obtain approval of such a plan by a BOEM Regional Supervisor before exploration activities may commence.

exploratory well – a well drilled in unproven or semi-proven territory for the purpose of ascertaining the presence underground of a commercially producible deposit of petroleum or natural gas.

fault – a fracture in the earth's crust accompanied by a displacement of one side of the fracture with respect to the other.

fauna – the animals occurring in a particular region or time.

fixed or bottom founded – permanently or temporarily attached to the seafloor.

flora – the plant life occurring in a particular region or time.

flyway – an established air route of migratory birds.

fugitive emissions – emission into the atmosphere that could not reasonably pass through a stack, chimney, vent or other functionally equivalent opening.

geochemical – of or relating to the chemistry of the earth, especially the measurement and interpretation of geochemical properties of geologic and hydrologic features in an area.

geologic hazard – a feature or condition that, if unmitigated, may seriously jeopardize offshore oil and gas exploration and development activities. Mitigation may necessitate special engineering procedures or relocation of a well.

geophysical – of or relating to the physics of the earth, especially the measurement and interpretation of geophysical properties of the rocks in an area.

geophysical survey – the exploration of an area during which geophysical properties and relationships unique to the area are measured by one or more geophysical methods.

habitat –a specific type of place that is occupied by an organism, a population, or a community; a specific type of place defined by its physical or biological environment that is occupied by an organism, a population, or a community.

harassment – an intentional or negligent act or omission that creates the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavioral patterns that include, but are not limited to, feeding or sheltering.

haulout area – specific locations where marine mammals come ashore and concentrate in numbers to rest, breed, and/or bear young.

herbivores – animals whose diet consists of plant material.

hydrocarbon – any of a large class of organic compounds containing primarily carbon and hydrogen; comprising paraffins, olefins, members of the acetylene series, alicyclic hydrocarbons, and aromatic hydrocarbons; and occurring, in many cases, in petroleum, natural gas, coal, and bitumens.

hypoxia – depressed levels of dissolved oxygen in water, usually resulting in decreased metabolism.

incidental take – take of a threatened or endangered fish or wildlife species that results from, but is not the purpose of, carrying out an otherwise lawful activity conducted by a federal agency or applicant (see take).

indirect effects – effects caused by activities that are stimulated by an action but not directly related to it.

industry infrastructure – the facilities associated with oil and gas development (e.g., refineries, gas processing plants, etc.).

information to lessees – information included in the Notice of Sale to alert lessees and operators of special concerns in or near a sale area of regulatory provisions enforceable by federal or state agencies.

jack-up rig – a barge-like floating platform with legs at each corner that can be lowered to the sea bottom to raise the platform above the water; a drilling platform with retractable legs that can be lowered to the sea bottom to raise the platform above the water.

landfall – the site at which a marine pipeline comes to shore.

macroinvertebrate – animals such as worms, clams, or crabs that are large enough to be seen without the aid of a microscope.

marine sanctuary – area established and protected under the Marine Protection, Research, and Sanctuaries Act (MPRSA) of 1972.

marshes – an area of low-lying land that is flooded in wet seasons or at high tide, and typically remains waterlogged at all times.

military warning area – an area established by the U.S. Department of Defense (USDOD) within which the public is warned that military activities take place.

minerals – as used in this document, minerals include oil, gas, sulfur, and associated resources, and all other minerals authorized by an Act of Congress to be produced from public lands, as defined in Section 103 of the Federal Land Policy and Management Act of 1976.

mitigation –(a) Avoiding an impact altogether by not taking a certain action or parts of an action. (b) Minimizing an impact by limiting the degree or magnitude of the action and its implementation. (c) Rectifying an impact by repairing, rehabilitating, or restoring the affected environment. (d) Reducing or eliminating an impact over time by preservation and maintenance operations during the life of the action. (e) Compensating for an impact by replacing or providing substitute resources or environments.

mollusks – animal phylum characterized by soft body parts including clams, mussels, snails, squid, and octopus.

mud – the liquid circulated through the wellbore during rotary drilling operations. In addition to its function of bringing cuttings to the surface, drilling mud cools and lubricates the bit and drill stem, protects against blowouts by holding back subsurface pressures, and deposits a mud cake on the wall of the borehole to prevent loss of fluids to the formations; also called drilling mud or drilling fluid; also a designation for sediment composed of silt and clay-sized particles.

mysids – small shrimp-like organisms, also known as opossum shrimp due to their method of egg incubation.

natural gas – hydrocarbons that are in a gaseous phase under atmospheric conditions of temperature and pressure.

nearshore waters – offshore open waters that extend from the shoreline out to the limit of the territorial seas (12 nmi).

nonattainment area – an area that is shown by monitoring data or air quality modeling calculations to exceed primary or secondary ambient air quality standards established by the USEPA.

offloading – another name for unloading; offloading refers more specifically to liquid cargo, crude oil, and refined products.

operator – the person or company engaged in the business of drilling for, producing, or processing oil, gas, or other minerals and recognized by BOEM as the official contact responsible for the lease activities or operations.

organic matter – tissue derived from living plant or animal organisms.

outer continental shelf (OCS) – all submerged lands that comprise the continental margin adjacent to the United States and seaward of state offshore lands.

petroleum – an oily, flammable, bituminous liquid that occurs in many places in the upper strata of the earth, either in seepages or in reservoirs; essentially a complex mixture of hydrocarbons of different types with small amounts of other substances; any of various substances (as natural gas or shale oil) similar in composition to petroleum.

phytoplankton – plant (photosynthetic) plankton; microscopic, freefloating, photosynthetic organisms that drift passively in the water.

pinniped – any of a suborder (Pinnipedia) of aquatic carnivorous mammals (e.g., seals, sea lions, sea otters, walruses) with all four limbs modified into flippers.

plankton – passively floating or weakly motile aquatic plants and animals.

planning area – a subdivision of an offshore area used as the initial basis for considering blocks to be offered for lease in the U.S. Department of the Interior's area-wide offshore oil and gas leasing program.

platform – a steel, concrete, or gravel structure from which offshore development wells are drilled.

post-lease – any activity on a block or blocks after the issuance of a lease on said block or blocks.

potential impact (effect) – the range of alterations or changes to environmental conditions that could be caused by an action.

primary production – production of carbon by a plant through photosynthesis over a given period of time; oil and gas production that occurs from the reservoir energy inherent in the formation.

produced water – total water produced from the oil and gas extraction process; the water may be discharged after treatment or reinjected; production water or production brine.

production – activities that take place after the successful completion, by any means, of the removal of minerals, including such removal, field operations, transfer of minerals to shore, operation monitoring, maintenance, and workover drilling.

production well – a well that is drilled for the purpose of producing oil or gas reserves; it is sometimes termed a development well.

program area – the geographical area of the OCS being offered for lease for the exploration, development, and production of mineral resources.

programmatic mitigation – measures either currently in place (e.g., Notice to Lessees [NTLs)] or to be developed and applied in a programmatic context to reduce the level and/or likelihood of impact to identified sensitive resources (e.g., Environmentally Important Areas, specific species or habitats).

prospect – an untested geologic feature having the potential for trapping and accumulating hydrocarbons.

recoverable oil – portion of the identified oil or gas resources that can be economically extracted under current technological constraints.

reserves – portion of the identified oil or gas resource that can be economically extracted.

reservoir – a subsurface, porous, permeable rock body in which hydrocarbons have accumulated.

rig – a structure or vessel used for drilling an oil or gas well.

right-of-way – a legal right of passage, an easement; the specific area or route for which permission has been granted to place a pipeline, (and) ancillary facilities, and for normal maintenance thereafter.

rookery – the nesting or breeding grounds of gregarious (i.e., social) birds or mammals; also a colony of such birds or mammals.

scoping – the process prior to EIS preparation to determine the range and significance of issues to be addressed in the EIS for each proposed major federal action.

seagrass beds – more or less continuous mats of submerged, rooted marine flowering vascular plants occurring in shallow tropical and temperate waters. Seagrass beds provide habitat, including breeding and feeding grounds, for adults and/or juveniles of many of the economically important shellfish and finfish.

sediment – mineral or organic material that has been transported and deposited by water, wind, glacier, precipitation, or gravity; a mass of deposited material.

seeps (hydrocarbon) – gas, oil, or other hydrocarbons that reach the surface along bedding planes, fractures, unconformities, or fault planes through connected porous rocks.

seismic – pertaining to, characteristic of, or produced by earthquakes or earth vibration; having to do with elastic waves in the earth; also geophysical when applied to surveys.

semi-submersible – a floating offshore drilling structure that has a hull which is submerged in the water but not resting on the seafloor.

stipulations – specific measures imposed upon a lessee that apply to a lease. Stipulations are attached as a provision of a lease; they may apply to some or all tracts in a sale. For example, a stipulation might limit drilling to a certain time period of the year or to certain areas.

subsistence uses – the customary and traditional uses by rural residents of wild, renewable resources for direct personal or family consumption as food, shelter, fuel, clothing, tools, or transportation; for making and selling of handcraft articles out of nonedible byproducts of fish and wildlife resources taken for personal or family consumption; for barter, or sharing for personal or family consumption; and for customary trade.

support vessel – a vessel that is designed for cargo-carrying flexibility and transport of deck cargo (e.g., pipe, equipment, or drummed material), mud, potable and drinking water, diesel fuel, dry bulk cement, and personnel.

take – to harass, harm, pursue, hunt, shoot, wound, kill, capture, or collect a threatened or endangered fish or wildlife species, or attempt to engage in any such conduct; any such action in relation to a marine mammal whether or not that species is listed as threatened or endangered. (Harm includes habitat modification that impairs behavioral patterns, and harass includes actions that create the likelihood of injury to an extent that normal behavior patterns are disrupted.)

threatened species – any species that is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range, and which has been officially listed by the appropriate federal agency. Criteria for determination of threatened status can be found under "endangered species."

trawl – a large, tapered fishing net of flattened, conical shape that is typically towed along the sea bottom.

trophic – trophic levels refer to the hierarchy of organisms from photosynthetic plants to carnivores, such as man; feeding trophic levels refer to the hierarchy of organisms from photosynthetic plants to carnivores in which organisms at one level are fed upon by those at the next higher level (e.g., phytoplankton eaten by zooplankton eaten by fish).

turbidity – reduced water clarity resulting from the presence of suspended matter.

weathering – the aging of oil due to its exposure to the atmosphere and environment causing marked alterations in its physical and chemical makeup.

wetlands – areas periodically inundated or saturated by surface or groundwater and predominantly supporting vegetation typically adapted for life in saturated soil conditions.

zooplankton – animal plankton, mostly dependent on phytoplankton for its food source; small, free-floating animals, may be passive drifters or motile, dependent on phytoplankton as a food source.

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Appendix B

Ongoing and Reasonably Foreseeable Future Actions and Trends

Table B-1. Ongoing and Reasonably Foreseeable Future Actions and Trends – Arctic Region.

Type of Action or Trend	Associated Activities, Facilities, or Processes	Impact-Producing Factors	Affected Resources and Systems
Ongoing oil and gas exploration, development, and production activities and existing infrastructure (onshore, in state waters, and Canadian and Russian waters)	**Ongoing activities onshore and in state waters:** 35 producing oil fields Seismic surveys Exploratory drilling Offshore drilling vessels Bridges, roadways, and docks Processing facilities Waste disposal facilities Gravel and ice pads Artificial gravel islands Production wells Pipelines (gathering and carrier) Trans-Atlantic Pipeline System (TAPS) (Pump Station 1) Dredging Gravel mining Marine vessel traffic Vehicles and equipment traffic Aircraft traffic **Ongoing activities in Canadian waters:** MacKenzie Valley and onshore Yukon Arctic Islands MacKenzie Delta/Beaufort Sea **Ongoing activities in Russian waters:** (unknown)	Subaerial noise and subsea noise and vibration Facility lighting Engine emissions (marine vessels and vehicles and equipment) Fuel spills (marine vessels and vehicles and equipment) Oil spills (storage tanks and vessel casualty) Hazardous spills/releases Oil and chemical releases (wells and produced water) Chronic seafloor disturbance (anchors) Bottom sediment disturbance (turbidity and contaminant resuspension) Disturbance or injury of fish and wildlife Habitat displacement or degradation Deposition of fugitive dust Altered wildlife migration patterns (e.g., caribou) Collisions (wildlife with marine vessels and infrastructure) Resource consumption Same as for ongoing activities onshore and in state waters	Air quality, water quality, acoustic environment, marine and coastal habitats, marine and coastal fauna (fish, mammals, and birds), terrestrial habitat and fauna, sociocultural systems (local jobs and revenue, and subsistence harvesting), and cultural resources (if present) Same as for ongoing activities onshore and in state waters

Table B-1. Ongoing and Reasonably Foreseeable Future Actions and Trends – Arctic Region (Continued).

Type of Action or Trend	Associated Activities, Facilities, or Processes	Impact-Producing Factors	Affected Resources and Systems
Foreseeable future oil and gas exploration, development, and production activities and infrastructure (onshore, and in state waters)	**Foreseeable future activities onshore and in state waters:** Alaska (Gas) Pipeline Project New gas treatment plant (Prudhoe Bay) 32- in. pipeline (Point Thomson to Prudhoe Bay) 48-in. (main) pipeline system Compressor stations Marine vessel traffic (sealifts) Vehicles and equipment traffic Liquefied natural gas (LNG) shippers (Valdez option) Point Thomson Project (Beaufort) Central and satellite pads Production and injection wells Processing facility (including flare stacks) Pipelines Support facilities (offices, warehouses, maintenance buildings, camps, waste management facilities, and boat ramp) Water and electricity distribution systems Ice and gravel roads Airstrip Service pier Sealift facility and barge moorings Dredging and gravel mining Liberty Project (Beaufort) Expansion of existing infrastructure (Endicott Satellite Drilling Island) New bridge and ice road/ice pad Seismic surveys Marine vessel and vehicle traffic Production wells Water and gas injection wells Pipeline transport (TAPS) Gravel mining	Same as for ongoing activities onshore and in state waters (if developed)	Same as for ongoing activities onshore and in state waters (if developed)

Table B-1. Ongoing and Reasonably Foreseeable Future Actions and Trends – Arctic Region (Continued).

Type of Action or Trend	Associated Activities, Facilities, or Processes	Impact-Producing Factors	Affected Resources and Systems
Foreseeable future oil and gas exploration, development, and production activities and infrastructure (federal OCS waters)	**Foreseeable future activities in federal lands and Outer Continental Shelf (OCS) waters:** National Petroleum Reserve in Alaska (BLM land) Exploratory drilling (past and future) Research and monitoring (past) Beaufort and Chukchi Seas OCS Seismic surveys Exploratory drilling Marine vessel traffic Offshore drilling vessels Production wells		
Subsistence activities	Hunting and trapping Fishing Whaling and sealing Onshore camping (crews) Small marine vessel traffic (*umiat* and aluminum skiffs)	Resource consumption	Marine, coastal, and terrestrial fauna
Marine vessel traffic	Cargo vessels Tugs and barges Service vessels Cruise ships (limited) Spill-response vessels Hovercraft Military vessels Research vessels (icebreakers) Small watercraft (hunting and intra-village transportation)	Noise Fuel spills Engine emissions Discharges of bilge water and waste Oil spills (vessel casualty) Increased wave action (nearshore) Collisions (wildlife with marine vessels) Collisions (among vessels)	Air quality, water quality, acoustic environment, marine and coastal habitats, marine and coastal fauna (fish, marine mammals, and birds), and sociocultural systems (subsistence harvesting)

Table B-1. Ongoing and Reasonably Foreseeable Future Actions and Trends – Arctic Region (Continued).

Type of Action or Trend	Associated Activities, Facilities, or Processes	Impact-Producing Factors	Affected Resources and Systems
Scientific research	Marine vessel traffic (including submersibles) Sampling, tagging, and tracking species of interest Seismic surveys Drilling Sediment and subsurface sampling Well installation and geophysical logging	Subsea noise and vibration Disturbance of wildlife Bottom sediment disturbance (turbidity and contaminant resuspension)	Water quality, acoustic environment, marine and coastal habitats, and marine and coastal fauna (fish, marine mammals, and birds)
Wastewater discharge to Arctic waters	Discrete conveyances such as pipes or man-made ditches from sewage treatment plants, industrial facilities, and power generating plants Drilling wastes (offshore) Marine vessel discharge	Permitted releases to water Pollutant releases via surface runoff (non-point sources)	Water quality, marine and coastal habitats, marine and coastal fauna (fish, mammals, and birds), commercial and recreational fisheries, and sociocultural systems (local communities and subsistence harvesting)
Persistent contaminants and marine debris	Accumulation of contaminants from multiple sources (discharges, spills, and releases; and atmospheric deposition) Accumulation of floating, submerged, and beached debris	Exposure to contaminants in marine waters and sediments, and in the food web via toxicity or bioaccumulation Collisions (marine vessels with debris) Entanglement in or ingestion of debris by marine wildlife Habitat displacement and/or degradation	Water (and sediment) quality, marine and coastal habitats, marine and coastal fauna (fish, mammals, and birds), commercial and recreational fisheries, and sociocultural systems (subsistence harvesting)
Military operations	Aircraft traffic Marine vessel traffic (submarines and icebreakers)	Subaerial and subsea noise Engine emissions (marine vessels) Fuel spills (marine vessels) Discharges of bilge water and waste Oil spills (vessel casualty) Collisions (wildlife with marine vessels)	Air quality, water quality, acoustic environment, marine and coastal habitats, and marine and coastal fauna (fish, marine mammals, and birds), and sociocultural systems (subsistence harvesting)

Table B-1. Ongoing and Reasonably Foreseeable Future Actions and Trends – Arctic Region (Continued).

Type of Action or Trend	Associated Activities, Facilities, or Processes	Impact-Producing Factors	Affected Resources and Systems
Mining (coal and minerals)	Red Dog Mine (Chukchi) Open pit lode mine (lead and zinc) Mineral extraction (drilling, blasting, loading, and hauling of ore) Waste rock and ore stockpiles Tailings impoundments Incinerator Solid waste disposal areas Vehicle traffic (transport of ore to port facility) Marine vessel traffic (transport of ore by barge from port facility) Mine expansion (to include Aqqaluk deposit) Reclamation activities (e.g., grading) Coal Development in Northern Alaska Nanushak project (proposed) Other (placer) mining (Chukchi) Possible use of mercury amalgamation (of gold placers)	Noise Permitted releases to air and water Particulate and dust releases to air Pollutant releases via surface runoff (non-point sources) Engine emissions (marine vessels and vehicles and equipment) Fuel spills (marine vessels and vehicles and equipment) Deposition of fugitive dust Collisions (wildlife with marine vessels)	Air quality, water quality, marine and coastal habitats, marine and coastal fauna (fish, mammals, and birds), and sociocultural systems (local jobs and revenue, and subsistence harvesting).
Dredging and marine disposal	Excavation for artificial islands and shipping corridors (oil and gas industry) Excavation for harbors, and nearshore channels and mooring basins Transport or conveyance of dredged materials (by barge or pipeline)	Noise Bottom sediment disturbance (turbidity and contaminant resuspension)	Water quality, acoustic environment, marine and coastal habitats, marine and coastal fauna (fish and marine mammals), and cultural resources (if present)
Recreation and tourism	Wildlife viewing Aircraft traffic Marine vessel traffic (cruise ships and commercial vessels) Recreational/sport fishing and hunting Recreational activities (e.g., rafting) Cruise ships and commercial vessels	Noise Disturbance or injury of fish and wildlife Habitat displacement and/or degradation	Water quality, marine and coastal habitats, marine and coastal fauna (fish, mammals, and birds), and sociocultural systems (jobs and revenues; subsistence harvesting)

Table B-1. Ongoing and Reasonably Foreseeable Future Actions and Trends – Arctic Region (Continued).

Type of Action or Trend	Associated Activities, Facilities, or Processes	Impact-Producing Factors	Affected Resources and Systems
Climate change	Increase in atmospheric temperatures Increase in precipitation rates Sea level rise and coastal erosion Reduction in extent of September sea ice Reduction in multi-year sea ice Thawing of permafrost	Changes in water quality (temperature, salinity, and pH) Changes in water circulation Increased navigability	Air quality, water quality, marine and coastal habitats, and marine and coastal fauna (fish, marine mammals, and birds), commercial and recreational fisheries, and sociocultural systems (community structures infrastructure, and subsistence harvesting)
Legislative actions (existing and forthcoming)	Federal statutes and regulations Executive orders State statutes and regulations International agreements	Management and protection of various resources throughout the marine and coastal regions of the Beaufort and Chukchi Seas	All resources

Table B-2. Ongoing and Reasonably Foreseeable Future Actions and Trends – Cook Inlet.

Type of Action or Trend	Associated Activities, Facilities, or Processes	Impact-Producing Factors	Affected Resources and Systems
Ongoing oil and gas exploration, development, and production activities and existing infrastructure (onshore and in state waters)	Construction of infrastructure (ports, platforms, and pipelines) Onshore fuel storage tanks, refineries, pipelines, and transfer stations Pipeline landfalls Seismic surveys Exploratory drilling Waste generation (produced water, drilling fluids, and muds/cuttings) Oil and gas production Decommissioning (plugging production wells and removing infrastructure) Vessel traffic Air traffic	Subaerial noise and subsea noise and vibration Platform lighting (offshore) Engine emissions (marine vessels) Fuel spills (marine vessels) Oil spills (storage tanks and vessel casualty) Hazardous spills/releases Oil and chemical releases (wells and produced water) Disturbance or injury of fish and wildlife Habitat displacement or degradation Chronic seafloor disturbance (by anchors and mooring lines) Bottom sediment disturbance (turbidity and contaminant resuspension) Resource consumption Collisions (wildlife with infrastructure and marine vessels) Collisions (among vessels)	Air quality, water quality, acoustic environment, marine and coastal habitats, marine and coastal fauna (fish, mammals, and birds), sociocultural systems (local jobs and revenue, and subsistence harvesting), and cultural resources (if present)
Commercial fishing	Fishing vessel traffic Use of gill nets, seines, purse seines, trawls, dredges, pots, jigs Use of diving equipment	Noise Fuel spills (fishing vessels) Disturbance of marine wildlife (e.g., ingestion and/or entanglement) Bottom sediment disturbance (turbidity and contaminant resuspension) Damage to hard bottoms Resource consumption	Water quality, acoustic environment, marine and coastal habitats, marine and coastal fauna (fish, marine mammals, and birds), and sociocultural systems (local jobs and revenue)

Table B-2. Ongoing and Reasonably Foreseeable Future Actions and Trends – Cook Inlet (Continued).

Type of Action or Trend	Associated Activities, Facilities, or Processes	Impact-Producing Factors	Affected Resources and Systems
Harbors, ports, and terminals	Port of Anchorage Port McKenzie Tyonek/North Forelands Drift River Oil Terminal Nikiski Industrial Terminals Port of Homer Seldovia Harbor Port Graham Williamsport	Noise Engine emissions (marine vessels) Fuel spills (marine vessels) Permitted discharges to air and water Pollutant releases via surface runoff (non-point sources) Oil spills (vessel casualty, pipeline or storage tank release) Hazardous spills/releases Accidental explosions or fires Cooled water releases (LNG plant) Collisions (wildlife with infrastructure and marine vessels) Collisions (among marine vessels)	Air quality, water quality, acoustic environment, coastal habitats, marine and coastal habitats, marine and coastal fauna (fish, marine mammals, and birds), commercial and recreational fisheries, sociocultural systems (local jobs, subsistence harvesting), and cultural resources (if present)
Port of Anchorage Intermodal Expansion Project	Dredging Placement of fill material Installation of sheet pile Additional road, rail, and utility extensions Installation of final docks Installation of fendering systems Demolition of existing docks Marine vessel traffic Vehicle traffic and equipment	Noise and vibration Engine emissions (marine vessels and vehicles and equipment) Fuel spills (marine vessels and vehicles and equipment) Disturbance or injury of fish and wildlife Habitat displacement or degradation Bottom sediment disturbance (turbidity and contaminant resuspension) Permitted discharges to air and water Pollutant releases via surface runoff (non-point sources) Oil spills (marine vessel casualty) Collisions (wildlife with infrastructure and marine vessels) Collisions (among marine vessels)	Air quality, water quality, acoustic environment, coastal habitats, benthic and marine habitats, marine and coastal fauna (fish, marine mammals, and birds), commercial and recreational fisheries, sociocultural systems (local jobs, subsistence harvesting), and cultural resources (if present)

Table B-2. Ongoing and Reasonably Foreseeable Future Actions and Trends – Cook Inlet (Continued).

Type of Action or Trend	Associated Activities, Facilities, or Processes	Impact-Producing Factors	Affected Resources and Systems
Knik Arm Crossing Project	Construction of bridge and roads Pile driving Artificial lighting Vessel traffic Vehicle traffic across bridge (once operational)	Noise Engine emissions (marine vessels and vehicles and equipment) Fuel spills (marine vessels and vehicles and equipment) Disturbance or injury of fish and wildlife Habitat displacement and/or degradation Collisions (wildlife with marine vessels)	Air quality, water quality, acoustic environment, marine and coastal habitats, marine and coastal fauna (fish, mammals, and birds), sociocultural systems (local jobs and recreational facilities), and cultural resources (historic buildings or properties)
Marine vessel traffic	Crude oil tankers LNG tankers Tugs and barges Ferries Commercial vessels Commercial fishing vessels Military vessels Coal carrier Government vessels Dredge vessels U.S. Coast Guard (USCG) vessels Cruise ships Small watercraft	Noise Engine emissions (marine vessels) Fuel spills (marine vessels) Discharges of bilge water and waste Oil spills (vessel casualty) Increased wave action (nearshore) Collisions (wildlife with marine vessels) Collisions (among marine vessels)	Air quality, water quality, acoustic environment, marine and coastal habitats, marine and coastal fauna (fish, marine mammals, and birds), and sociocultural systems (subsistence harvesting)
Wastewater discharge to Cook Inlet	Discrete conveyances such as pipes or man-made ditches from sewage treatment plants, industrial facilities, and power generating plants Drilling wastes (offshore) Marine vessel and platform discharges	Permitted releases to water Pollutant releases via surface runoff (non-point sources)	Water quality, marine and coastal habitats, marine and coastal fauna (fish, marine mammals, and birds), commercial and recreational fisheries, and sociocultural systems (local communities and subsistence harvesting)

Table B-2. Ongoing and Reasonably Foreseeable Future Actions and Trends – Cook Inlet (Continued).

Type of Action or Trend	Associated Activities, Facilities, or Processes	Impact-Producing Factors	Affected Resources and Systems
Persistent contaminants and marine debris	Accumulation of contaminants from multiple sources (discharges, spills, and releases, and atmospheric deposition) Accumulation of floating, submerged, and beached debris	Exposure to contaminants in marine waters and sediments, and in the food web via toxicity or bioaccumulation Collisions (marine vessels with debris) Entanglement in or ingestion of debris by marine wildlife Habitat displacement and/or degradation	Water (and sediment) quality, marine and coastal habitats, marine and coastal fauna (fish, mammals, and birds), commercial and recreational fisheries, and sociocultural systems (subsistence harvesting)
Alternate energy development	Ocean Renewable Power Company (ORPC) Cook Inlet Tidal Energy Project Tidal energy (East Foreland) Wind energy project (Fire Island) underwater transmission line Turnagain Arm Tidal Energy Corporation (TATEC) Tidal energy project (Turnagain Arm) underwater transmission line	Subsea noise and vibration Bottom sediment disturbance (turbidity and contaminant resuspension) Collisions (wildlife with infrastructure)	Acoustic environment, marine and coastal habitats, marine and coastal fauna (fish, marine mammals, and birds), and cultural resources (if present)
Military operations	Joint Base Elmendorf-Richardson (JBER) Airfield and aircraft traffic Combat training center Munitions storage Community facilities and residences Communication centers Impact areas and firing ranges (onshore) Maneuver areas (onshore) Major ranges (onshore) Contaminated sites (currently undergoing remediation)	Noise and vibration Disturbance or injury of fish and wildlife Disturbance of nearby residents Contaminant releases	Air quality, water quality, acoustic environment, marine and coastal habitats, and marine and coastal fauna (fish, marine mammals, and birds), and sociocultural systems (local communities and subsistence harvesting)

Table B-2. Ongoing and Reasonably Foreseeable Future Actions and Trends – Cook Inlet (Continued).

Type of Action or Trend	Associated Activities, Facilities, or Processes	Impact-Producing Factors	Affected Resources and Systems
Mining (coal and minerals)	Chuitna Coal Project Surface coal mine Support facilities Mine access road Coal transport conveyor Personnel housing Air strip facility Logistic center Coal export terminal Marine vessel traffic Aircraft traffic Vehicle traffic and equipment Pebble Mining Project Mine pit or workings Access infrastructure Power facilities Mill Tailings storage Low-grade ore stockpiles Warehouses Administrative facilities Worker housing Vehicle traffic and equipment Abandoned mine lands	Noise and vibration Coal particulate and dust releases to air Soil erosion (from land disturbance) Deposition of fugitive dust Permitted releases to water Pollutant releases via surface runoff (non-point sources) Engine emissions (marine vessels and vehicles and equipment) Fuel spills (marine vessels and vehicles and equipment) Disturbance or injury of fish and wildlife Collisions (wildlife with marine vessels) Collisions (among marine vessels) Particulate releases to air Engine emissions (vehicles and equipment) Permitted releases to water Soil erosion (from land disturbance) Pollutant releases via surface runoff (non-point sources) Disturbance or injury of wildlife	Air quality, water use (and patterns of recharge/discharge), water quality, acoustic environment, marine and coastal habitats, marine and coastal fauna (fish, marine mammals, and birds), and sociocultural systems (local jobs and revenue, and subsistence harvesting) Air quality, groundwater quality, surface water quality and stream flow, marine and coastal habitats, marine and coastal fauna (fish, marine mammals, and birds), and sociocultural systems (local jobs and revenue, and subsistence harvesting)
Dredging and marine disposal	Excavation of subaqueous sediments by clamshell, hydraulic cutterhead, pipeline suction, or bulldozer Transport or conveyance of dredged materials (by barge or suction pipeline)	Bottom sediment disturbance (turbidity and contaminant resuspension)	Water quality, marine and coastal habitats, marine and coastal fauna (fish and marine mammals), and cultural resources (if present)

Table B-2. Ongoing and Reasonably Foreseeable Future Actions and Trends – Cook Inlet (Continued).

Type of Action or Trend	Associated Activities, Facilities, or Processes	Impact-Producing Factors	Affected Resources and Systems
Recreation and tourism	Shores and beaches Recreational fishing Water sports Cruise ships	Noise Disturbance or injury of fish and wildlife Habitat displacement and/or degradation Economic activity	Water quality, marine and coastal habitats, marine and coastal fauna (fish, mammals, and birds), and sociocultural systems (jobs and revenues, and subsistence harvesting)
Climate change	Increase in atmospheric and ocean temperatures Increase in precipitation rate Sea level rise and coastal erosion Ocean acidification	Changes in water quality (temperature, salinity, and pH) Changes in water circulation	Air quality, water quality, marine and coastal habitats, and marine and coastal fauna (fish, marine mammals, and birds)
Legislative actions (existing and forthcoming)	Federal statutes and regulations Executive orders State statutes and regulations	Management and protection of various resources throughout the marine and coastal regions of Cook Inlet	All resources

Table B-3. Ongoing and Reasonably Foreseeable Future Actions and Trends – Gulf of Mexico.

Type of Action or Trend	Associated Activities, Facilities, or Processes	Impact-Producing Factors	Affected Resources and Systems
Ongoing oil and gas exploration, development, and production (onshore, in state and federal OCS waters and Mexico's waters)	Construction of infrastructure, such as platforms and pipelines Onshore fuel storage tanks, refineries, and transfer stations Pipeline landfalls and/or installation Onshore support facilities (e.g., pipe yards) Operations and maintenance Seismic surveys Exploratory drilling Waste generation (produced water, drilling fluids, and muds/cuttings) Oil and gas production Decommissioning (plugging production wells and removing infrastructure) Marine vessel traffic Aircraft traffic	Subaerial noise and subsea noise and vibration Platform lighting (offshore) Engine emissions (marine vessels) Fuel spills (marine vessels) Oil spills (storage tanks and vessel casualty) Hazardous spills/releases Oil and chemical releases (wells and produced water) Disturbance or injury of fish and wildlife Habitat displacement and degradation Chronic seafloor disturbance (by anchors and mooring lines) Bottom sediment disturbance (turbidity and contaminant resuspension) Resource consumption Collisions (wildlife with infrastructure and marine vessels) Collisions (among marine vessels)	Air quality, water quality, marine and coastal habitats, marine and coastal fauna (fish, marine mammals, and birds), commercial and recreational fisheries, sociocultural systems (local jobs and revenue, and subsistence harvesting), and cultural resources (if present)
Existing oil and gas infrastructure (onshore, and in state and federal waters)	Ports Exploration wells Oil and gas pipelines Pipeline landfalls and/or installation Platforms Tanker vessels Louisiana Offshore Oil Port Onshore fuel storage tanks and transfer stations	Noise Engine emissions (marine vessels) Fuel spills (marine vessels) Oil spills/releases (tanker accidents, transfers, and pipeline or well releases) Hazardous spills/releases Collisions (wildlife with infrastructure and marine vessels) Collisions (among marine vessels)	Air quality, water quality, marine and coastal habitats, marine and coastal fauna (fish, marine mammals, and birds), commercial and recreational fisheries, sociocultural systems (local jobs and revenue, and subsistence harvesting), and cultural resources (if present)
Oil imports	Tanker traffic Lightering (transfer) operations	Noise Oil spills Engine emissions (tankers) Collisions (wildlife with tankers) Collisions (among marine vessels)	Air quality, water quality, marine and coastal habitats, and marine and coastal fauna (fish, marine mammals, and birds)

Table B-3. Ongoing and Reasonably Foreseeable Future Actions and Trends – Gulf of Mexico (Continued).

Type of Action or Trend	Associated Activities, Facilities, or Processes	Impact-Producing Factors	Affected Resources and Systems
Onshore industry and agriculture	Port facilities Erosion control structures (e.g., etties and groins) Platform fabrication yards Shipyards Support and transport facilities Pipelines Pipecoating plants and yards Natural gas processing plants and storage facilities Refineries Petrochemical plants Waste management facilities Vehicle traffic and equipment Agricultural crops and livestock	Noise Erosion of downdrift areas Engine emissions (marine vessels and vehicles and equipment) Fuel spills (marine vessels and vehicles and equipment) Permitted discharges to air and water Pollutant releases via surface runoff (non-point sources) Hazardous spills/releases Collisions (wildlife with vessels and infrastructure)	Air quality, water quality, coastal habitats, benthic and marine habitats, marine and coastal fauna (fish, marine mammals, and birds), commercial and recreational fisheries, sociocultural systems (local jobs, subsistence harvesting), and cultural resources (if present)
Commercial fishing	Fishing vessel traffic Use of drifting gear (purse nets and bottom longlines) Use of pots and traps Use of hook and line Bottom trawling Surface longlining	Noise Fuel spills (fishing vessels) Disturbance or injury of marine wildlife (e.g., ingestion and/or entanglement) Bottom sediment disturbance (turbidity and contaminant resuspension) Damage to hard bottoms (e.g., reefs) Resource consumption	Water quality, marine and coastal habitats, marine and coastal fauna (fish, marine mammals, and birds), and sociocultural systems (local jobs and revenue)
Alternate energy development	Wind, wave, and ocean current technologies; pilot projects	Subaerial noise and subsea noise and vibration Bottom sediment disturbance (turbidity and contaminant resuspension) Collisions (wildlife with infrastructure)	Marine and coastal habitats, marine and coastal fauna (fish, marine mammals, and birds), and cultural resources (if present)

Table B-3. Ongoing and Reasonably Foreseeable Future Actions and Trends – Gulf of Mexico (Continued).

Type of Action or Trend	Associated Activities, Facilities, or Processes	Impact-Producing Factors	Affected Resources and Systems
Military operations	Surface marine vessel traffic Aircraft traffic Aerial operations (e.g., flight training) Submarine operations Offshore dumping areas (ordnance, chemical waste, vessel waste)	Subaerial noise and subsea noise and vibration Engine emissions (marine vessels) Fuel spills (marine vessels) Disturbance or injury of fish and wildlife Bottom sediment disturbance (turbidity and contaminant resuspension) Contaminant releases Collisions (wildlife with marine vessels)	Water quality, marine and coastal habitats, and marine and coastal fauna (fish, marine mammals, and birds)
Marine vessel traffic	Crude oil tankers LNG tankers Commercial container vessels Tugs and barges Military vessels USCG vessels (search, rescue, and homeland security) Cruise ships Commercial fishing vessels Small watercraft	Noise Engine emissions (marine vessels) Fuel spills (marine vessels) Discharges of bilge water and waste Oil spills (vessel casualty) Increased wave action (nearshore and along navigation channels) Collisions (wildlife with marine vessels) Collisions (among marine vessels)	Air quality, water quality, marine and coastal habitats, and marine and coastal fauna (fish, marine mammals, and birds)
Scientific research	Oceanographic and biological surveys Marine vessel traffic (including submersibles) Sampling, tagging, and tracking species of interest Seismic surveys Drilling Sediment and subsurface sampling Well installation and geophysical logging	Subsea noise and vibration Disturbance or injury of wildlife Bottom sediment disturbance (turbidity and contaminant resuspension)	Water quality, marine and coastal habitats, and marine and coastal fauna (fish, marine mammals, and birds)
LNG import terminals (offshore)	Operation of existing LNG terminal Tanker traffic	Accidental explosions or fires Cooled water releases Fuel spills (tankers) Collisions (wildlife with tankers)	Water quality, marine and coastal habitats, marine and coastal fauna (fish and marine mammals)

Table B-3. Ongoing and Reasonably Foreseeable Future Actions and Trends – Gulf of Mexico (Continued).

Type of Action or Trend	Associated Activities, Facilities, or Processes	Impact-Producing Factors	Affected Resources and Systems
Marine mineral mining	Marine vessel traffic Bottom sampling and shallow coring Mining (coastal waters) Coastal and barrier island restoration Beach nourishment Public works projects	Noise Bottom sediment disturbance (turbidity and contaminant resuspension) Resource consumption	Water quality, and marine and coastal habitats
Wastewater discharge to Mississippi-Atchafalaya River Basin watershed and Gulf of Mexico waters	Discrete conveyances such as pipes or man-made ditches from sewage treatment plants, industrial facilities, and power generating plants Drilling wastes (offshore) Marine vessel and platform discharges	Permitted releases to water Pollutant releases via surface runoff (non-point sources)	Water quality, marine and coastal habitats, marine and coastal fauna (fish, mammals, and birds), commercial and recreational fisheries, and sociocultural systems (local communities and subsistence harvesting)
Persistent contaminants and marine debris	Accumulation of contaminants from multiple sources (discharges, spills, and releases; and atmospheric deposition) Accumulation of floating, submerged, and beached debris	Exposure to contaminants in marine waters and sediments, and in the food web via toxicity or bioaccumulation Collisions (marine vessels with debris) Entanglement in or ingestion of debris by marine wildlife Habitat displacement and/or degradation	Water (and sediment) quality, marine and coastal habitats, marine and coastal fauna (fish, mammals, and birds), commercial and recreational fisheries, and sociocultural systems (subsistence harvesting)
Hypoxic zone in northern Gulf of Mexico	Accumulation of nutrients mainly from Mississippi-Atchafalaya River Basin watershed Seasonal zone of depleted dissolved oxygen (increasing in size and over the past 50 years)	Exposure to low dissolved oxygen levels in marine waters (with mortality and reproduction impacts also affecting food web) Habitat displacement and/or degradation	Water quality, marine and coastal habitats, marine and coastal fauna (benthic organisms and fish), commercial and recreational fisheries, and sociocultural systems (subsistence harvesting)
Dredging and marine disposal	Excavation of subaqueous sediments Transport of sediments (by dredger or pipeline) Relocation and disposal of sediments	Noise Reduction of sediment deposition on downdrift landforms Bottom sediment disturbance (turbidity and contaminant resuspension)	Water quality, marine and coastal habitats, marine and coastal fauna (fish and marine mammals), and cultural resources (if present)

Table B-3. Ongoing and Reasonably Foreseeable Future Actions and Trends – Gulf of Mexico (Continued).

Type of Action or Trend	Associated Activities, Facilities, or Processes	Impact-Producing Factors	Affected Resources and Systems
Recreation and tourism	Shores and beaches Resorts, marinas, parks, and gardens Recreational and sport fishing Water sports Cruise ships	Noise Disturbance or injury of fish and wildlife Habitat displacement and/or degradation Economic activity	Air quality, water quality, marine and coastal habitats, marine and coastal fauna (fish, marine mammals, and birds), and sociocultural systems (jobs and revenues, and subsistence harvesting)
Climate change	Increase in atmospheric and ocean temperatures Increase in precipitation rate Increase in storm frequency and intensity Sea level rise and coastal erosion Ocean acidification	Changes in water quality (temperature, salinity, and pH) Changes in water circulation Changes in storm frequency and intensity Saltwater intrusion (coastal aquifers)	Air quality, water quality, marine and coastal habitats, and marine and coastal fauna (fish, marine mammals, and birds)
Legislative actions (existing and forthcoming)	Federal statutes and regulations Executive Orders State statutes and regulations International agreements	Management and protection of various resources throughout the marine and coastal regions of the Gulf of Mexico	All resources

Table B-4. Ongoing and Reasonably Foreseeable Future Actions and Trends – Atlantic Region.

Type of Action or Trend	Associated Activities, Facilities, or Processes	Impact-Producing Factors	Affected Resources and Systems
Oil imports	Tanker traffic Lightering (transfer) operations	Noise Oil spills Engine emissions (tankers) Collisions (wildlife with tankers) Collisions (among marine vessels)	Air quality, water quality, marine and coastal habitats, and marine and coastal fauna (fish, marine mammals, and birds)
Foreseeable future oil and gas exploration, development, and production activities and infrastructure (federal OCS waters)	Onshore facilities (in support of seismic surveys) Waste disposal Seismic surveys	Subaerial noise and subsea noise and vibration Engine emissions (marine vessels) Fuel spills (marine vessels) Oil spills (storage tanks and vessel casualty) Hazardous spills/releases Disturbance or injury of fish and wildlife Habitat displacement and degradation Resource consumption Collisions (wildlife with marine vessels) Collisions (among marine vessels)	Air quality, water quality, marine and coastal habitats, marine and coastal fauna (fish, marine mammals, and birds), commercial and recreational fisheries, sociocultural systems, and cultural resources (if present)

Table B-4. Ongoing and Reasonably Foreseeable Future Actions and Trends – Atlantic Region (Continued).

Type of Action or Trend	Associated Activities, Facilities, or Processes	Impact-Producing Factors	Affected Resources and Systems
Onshore industry and agriculture	Port facilities Erosion control structures (e.g., jetties and groins) Platform fabrication yards Shipyards Support and transport facilities Pipelines Pipecoating plants and yards Natural gas processing plants and storage facilities Refineries Petrochemical plants Waste management facilities Vehicle traffic and equipment Agricultural crops and livestock	Noise Erosion of downdrift areas Engine emissions (marine vessels and vehicles and equipment) Fuel spills (marine vessels and vehicles and equipment) Permitted discharges to air and water Pollutant releases via surface runoff (non-point sources) Hazardous spills/releases Collisions (wildlife with vessels and infrastructure)	Air quality, water quality, coastal habitats, benthic and marine habitats, marine and coastal fauna (fish, marine mammals, and birds), commercial and recreational fisheries, sociocultural systems (local jobs, subsistence harvesting), and cultural resources (if present)
Commercial fishing	Fishing vessel traffic Use of drifting gear (purse nets and bottom longlines) Use of pots and traps Use of hook and line Bottom trawling Surface longlining	Noise Fuel spills (fishing vessels) Disturbance or injury of marine wildlife (e.g., ingestion and/or entanglement) Bottom sediment disturbance (turbidity and contaminant resuspension) Damage to hard bottoms (e.g., reefs) Resource consumption	Water quality, marine and coastal habitats, marine and coastal fauna (fish, marine mammals, and birds), and sociocultural systems (local jobs and revenue)
Alternate energy development	Wind technologies, pilot projects	Subaerial noise and subsea noise and vibration Bottom sediment disturbance (turbidity and contaminant resuspension) Collisions (wildlife with infrastructure)	Marine and coastal habitats, marine and coastal fauna (fish, marine mammals, and birds), and cultural resources (if present)

Table B-4. Ongoing and Reasonably Foreseeable Future Actions and Trends – Atlantic Region (Continued).

Type of Action or Trend	Associated Activities, Facilities, or Processes	Impact-Producing Factors	Affected Resources and Systems
Military and National Aeronautics and Space Administration (NASA) operations	**U.S. Department of Defense (USDOD)/U.S. Navy:** Surface marine vessel traffic Aircraft traffic Aerial operations (e.g., flight training) Testing ranges (Naval Undersea Warfare Center, including research, development, test and evaluation for submarines, autonomous underwater systems and offensive and defensive undersea weapon systems; Naval Surface Warfare Center, including research, development, test and evaluation for surface and undersea vehicles and associated systems; Jacksonville Range Complex, including Navy Atlantic Fleet training; research, development, testing, and evaluation activities; and associated range capabilities enhancements in the Jacksonville and Charleston operating areas (OPAREAs), etc.) Submarine operations Offshore dumping areas (ordnance, chemical waste, vessel waste) **NASA:** NASA's Wallops Island Flight Facility (WFF) – offshore launch hazard area	Subaerial noise and subsea noise and vibration Engine emissions (marine vessels) Fuel spills (marine vessels) Disturbance or injury of fish and wildlife Bottom sediment disturbance (turbidity and contaminant resuspension) Contaminant releases Collisions (wildlife with marine vessels)	Water quality, marine and coastal habitats, and marine and coastal fauna (fish, marine mammals, and birds), space-use conflicts

Table B-4. Ongoing and Reasonably Foreseeable Future Actions and Trends – Atlantic Region (Continued).

Type of Action or Trend	Associated Activities, Facilities, or Processes	Impact-Producing Factors	Affected Resources and Systems
Marine vessel traffic	Crude oil tankers LNG tankers Commercial container vessels Tugs and barges Military vessels USCG vessels (search, rescue, and homeland security) Cruise ships Commercial fishing vessels Small watercraft	Noise Engine emissions (marine vessels) Fuel spills (marine vessels) Discharges of bilge water and waste Oil spills (vessel casualty) Increased wave action (nearshore and along navigation channels) Collisions (wildlife with marine vessels) Collisions (among marine vessels)	Air quality, water quality, marine and coastal habitats, and marine and coastal fauna (fish, marine mammals, and birds)
Scientific research	Oceanographic and biological surveys Marine vessel traffic (including submersibles) Sampling, tagging, and tracking species of interest Seismic surveys Drilling Sediment and subsurface sampling Well installation and geophysical logging	Subsea noise and vibration Disturbance or injury of wildlife Bottom sediment disturbance (turbidity and contaminant resuspension)	Water quality, marine and coastal habitats, and marine and coastal fauna (fish, marine mammals, and birds)
LNG import terminals (offshore)	Operation of existing LNL terminal Tanker traffic	Accidental explosions or fires Cooled water releases Fuel spills (tankers) Collisions (wildlife with tankers)	Water quality, marine and coastal habitats, marine and coastal fauna (fish and marine mammals)
Marine mineral mining	Marine vessel traffic Bottom sampling and shallow coring Mining (coastal waters) Coastal and barrier island restoration Beach nourishment Public works projects	Noise Bottom sediment disturbance (turbidity and contaminant resuspension) Resource consumption	Water quality, and marine and coastal habitats

Table B-4. Ongoing and Reasonably Foreseeable Future Actions and Trends – Atlantic Region (Continued).

Type of Action or Trend	Associated Activities, Facilities, or Processes	Impact-Producing Factors	Affected Resources and Systems
Persistent contaminants and marine debris	Accumulation of contaminants from multiple sources (discharges, spills, and releases; and atmospheric deposition) Accumulation of floating, submerged, and beached debris	Exposure to contaminants in marine waters and sediments, and in the food web via toxicity or bioaccumulation Collisions (marine vessels with debris) Entanglement in or ingestion of debris by marine wildlife Habitat displacement and/or degradation	Water (and sediment) quality, marine and coastal habitats, marine and coastal fauna (fish, mammals, and birds), commercial and recreational fisheries, and sociocultural systems (subsistence harvesting)
Dredging and marine disposal	Excavation of subaqueous sediments Transport of sediments (by dredger or pipeline) Relocation and disposal of sediments	Noise Reduction of sediment deposition on downdrift landforms Bottom sediment disturbance (turbidity and contaminant resuspension)	Water quality, marine and coastal habitats, marine and coastal fauna (fish and marine mammals), and cultural resources (if present)
Recreation and tourism	Shores and beaches Resorts, marinas, parks, and gardens Recreational and sport fishing Water sports Cruise ships	Noise Disturbance or injury of fish and wildlife Habitat displacement and/or degradation Economic activity	Air quality, water quality, marine and coastal habitats, marine and coastal fauna (fish, marine mammals, and birds), and sociocultural systems (jobs and revenues, and subsistence harvesting)
Climate change	Increase in atmospheric and ocean temperatures Increase in precipitation rate Increase in storm frequency and intensity Sea level rise and coastal erosion Ocean acidification	Changes in water quality (temperature, salinity, and pH) Changes in water circulation Changes in storm frequency and intensity Saltwater intrusion (coastal aquifers)	Air quality, water quality, marine and coastal habitats, and marine and coastal fauna (fish, marine mammals, and birds)
Legislative actions (existing and forthcoming)	Federal statutes and regulations Executive Orders State statutes and regulations International agreements	Management and protection of various resources throughout the marine and coastal regions of the Atlantic	All resources

Appendix C

Physical, Biological, Cultural, and Socioeconomic Environment

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Introduction

The Programmatic EIS (Environmental Impact Statement) addresses three Program Areas: the Alaska, the Gulf of Mexico, and the Atlantic, and each Program Area includes portions of multiple Bureau of Ocean Energy Management (BOEM) Planning Areas (Figures 2.1-1, 2.1-2, 2.1-3 in the Programmatic EIS). The Affected Environment descriptions in the Programmatic EIS, Chapter 4, succinctly describe and summarize the existing environment of the Program Areas in sufficient detail to support the impact analysis of the alternatives. The succinct descriptions avoid an encyclopedic Programmatic EIS and promote an analytic approach to the document. This Appendix provides more comprehensive information, including additional details regarding the affected environmental resources, and was considered during the preparation of the Programmatic EIS. However, for the following resources, all affected environmental information is included in Chapter 4:Affected Environment and Impact Analysis of the Programmatic EIS.

1.0. OTHER ENVIRONMENTAL CONCERNS

1.1. CLIMATE CHANGE

This Programmatic EIS focuses on three regions: the Gulf of Mexico Program Area, the Atlantic Program Area, and the Alaska Program Area. In this section, the impacts of climate change in these regions are assessed; the approach uses a regional spatial scale, and while the temporal scale varies, it focuses on long-term trends.

Evaluation of climate change has continued since the previous Programmatic EIS (U.S. Department of the Interior [USDOI], BOEM, 2012), bearing out observations of a rising, warming, and acidifying ocean. Previous key reports (e.g., National Research Council [NRC], 2010), and more recent governmental reports provide compelling scientific consensus that present-day climate warming trends are linked to human activities (Intergovernmental Panel on Climate Change [IPCC], 2014; Melillo et al., 2014; Blunden and Arndt, 2015), and predominantly are associated with cascading effects resulting from increasing emissions of greenhouse gases including carbon dioxide (Etheridge, 2010; Tans and Keeling, 2012; U.S. Department of Commerce [USDOC], National Oceanographic and Atmospheric Administration [NOAA],National Climatic Data Center [NCDC], 2012). Moreover, the rate of climate change is forecast to have strong potential for continuation and acceleration, although many note that consequences will be felt unevenly across ecosystems (Doney et al., 2014). As reported in the previous Programmatic EIS (USDOI, BOEM, 2012): “Climate change effects have been observed to be occurring on all continents and oceans, and these observations have provided insights on relationships among atmospheric concentrations of carbon dioxide and other greenhouse gases, mean global temperature increases, and observed effects on physical and biological systems” (IPCC, 2007).

Cascading effects on resources of concern and the services they provide manifest in numerous ways that vary both spatially and temporally. Secondary impacts of increasing atmospheric concentrations of carbon dioxide and other greenhouse gases include but are not limited to several key physico-chemical drivers: relative sea level rise (SLR), ocean acidification, ocean heat content, the intensity, return interval, duration and extent of storm events, changes in albedo (reflectivity), distribution and abundance of precipitation, and coastal erosion. These have been described in numerous reports (e.g., Boesch et al., 2000; Arctic Climate Impact Assessment [ACIA], 2005, 2010; Titus et al., 2009; Morel et al., 2010; Pendleton et al., 2010; Blunden et al., 2011; Blunden and Arndt, 2014; Merillo et al., 2015).

Tertiary effects of climate change on natural resource services arising from these key drivers are manifold, and include the distribution and abundance of both habitats and species. Associated with these climate change impacts are effects on critical habitats including sea ice loss (both a driver and a habitat), declining coral reef conditions, and loss of critical habitats such as estuaries, wetlands, barrier islands, and mangroves). Interestingly, not all habitats are projected to experience an overall decline as a result of climate change (e.g., see Dixon et al. [2015] for genetic response of coral to heating and Koch et al. [2013] for a discussion of projected increases in seagrass habitat with climate change).

As explained in the previous Programmatic EIS (USDOI, BOEM, 2012), the Earth's climate is driven by incoming solar energy. The balance of energy retention and loss in the atmosphere in turn determines global temperatures (Solomon et al., 2007). However, as atmospheric concentrations of greenhouse gases increase, the balance shifts towards energy retention, so temperatures increase. Because this "greenhouse effect" occurs in response to rising concentrations of gases, including carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), and halocarbons, these gases are referred to as "greenhouse gases". This shift is driven largely by anthropogenic increases in atmospheric CO_2 (**Figure 1.1-1**) which as early as 2004 accounted for 57 percent of global greenhouse emissions. Fossil fuel use is the primary source of CO_2 (while the global percentage contribution [as of 2004] of CO_2 stands at approximately 57 percent, the U.S. contribution is approximately 82 percent, with methane at 10 percent [U.S. Environmental Protection Agency (USEPA), 2015a]). The way in which people use land is also an important source of CO_2, especially when it involves deforestation. Land also can remove CO_2 from the atmosphere through reforestation, improvement of soils, and other activities. Agricultural activities, waste management, and energy use all contribute to CH_4 emissions. Agricultural activities, such as fertilizer use, are the primary source of N_2O emissions. Industrial processes, refrigeration, and the use of a variety of consumer products contribute to emissions of fluorinated gases (F-gases), which include hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF_6).

Emissions and concentrations of greenhouse gases in the atmosphere have increased dramatically since the beginning of the twentieth century as a result of anthropogenic input. Emissions of CO_2 are linked to a number of sectors including energy supply (26 percent), transportation (13 percent), residential and commercial buildings (8 percent), industry (19 percent), agriculture (14 percent), forestry (17 percent), and waste and wastewater (3 percent) (IPCC, 2007; Rogner et al., 2007). The climate system's response to the resultant positive radiative forcing is complicated by a number of positive and negative feedback processes among atmospheric, terrestrial, and oceanic ecosystems, but overall the climate is warming, as is evident by observed increases in air and ocean temperatures, melting snow and ice, and SLR (IPCC, 2007, 2014).

Emissions and concentrations of greenhouse gases in the atmosphere have increased dramatically since the beginning of the twentieth century as a result of anthropogenic input (**Figure C-1**). Emissions of CO_2 are linked to a number of sectors including energy supply (26 percent), transportation (13 percent), residential and commercial buildings (8 percent), industry (19 percent), agriculture (14 percent), forestry (17 percent), and waste and wastewater (3 percent) (IPCC, 2007a; Rogner et al., 2007). The climate system's response to the resultant positive radiative forcing is complicated by a number of positive and negative feedback processes among atmospheric, terrestrial, and oceanic ecosystems, but overall the climate is warming, as is evident by observed increases in air and ocean temperatures, melting snow and ice, and SLR (IPCC, 2007, 2014).

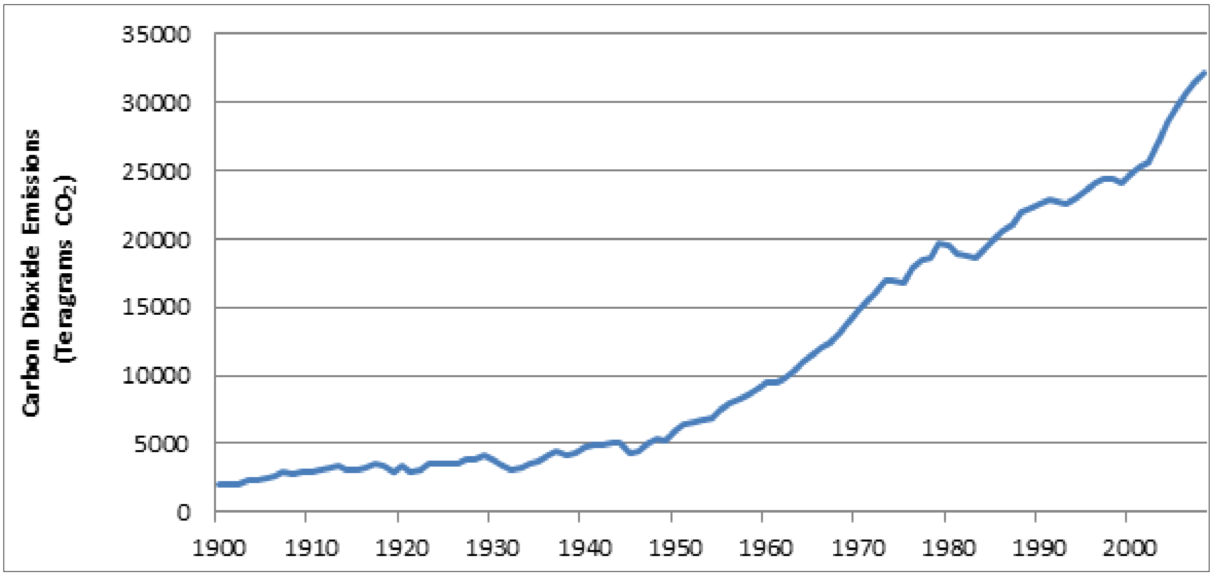


Figure C-1. Teragrams (10^{12} g) of CO_2 Emitted Globally Since 1900 (From: Boden et al., 2010).

Average temperature in the continental U.S. has increased approximately 0.3 degrees Celsius (°C) (32.5°F) since 1895, and most of this increase has occurred since 1970. The most recent decade was the nation's and the world's hottest on record, and 2012 was the hottest year on record in the continental U.S. (IPCC, 2014). The rate of warming for the past 50 years (yr) has been approximately twice that of the past 100 yr (Trenberth et al., 2007). Temperatures are projected to rise another 1.1 to 2.2°C (34 to 36°F) in most areas of the U.S. over the next few decades. The amount of warming projected beyond the next few decades is directly linked to cumulative global emissions of heat-trapping gases and particles. During the 21st century, average global atmospheric temperature is projected to rise 1.65 to 2.75°C (35 to 37°F), even under the lowest emission scenarios (IPCC, 2014).

Warming trends have not been spatially uniform, and in particular Arctic temperatures have increased about twice as much as those in lower latitudes (ACIA, 2005, 2010; Jefferies and Richter-Menge, 2014). For example, all regions of the U.S. have warmed over the last several decades, but in a non-uniform manner. The current trend is for temperatures to be rising more rapidly in northern latitudes (e.g., Alaska), and less in the southeastern U.S. (IPCC, 2014). Preferential warming in the Arctic is partially the result of a nonlinear, ice-albedo feedback, a consequence of high-albedo ice being replaced by more light-absorbing surfaces with a lower albedo, including both snow and ice-free land and water (Perovich et al., 2007; Winton, 2008; but see Bitz [2008] regarding forecasting uncertainty and data gaps).

The majority of heat energy associated with climate change is being absorbed by the oceans (National Research Council [NRC], 2010; Levitus et al., 2012). Although there are annual and decadal shifts in ocean heat content (Levitus et al., 2012), the trend for ocean heat content is strongly upward; ocean heat content in the upper 2,000 meters (m) (6,562 feet [ft]) of the water column has increased dramatically since the 1950s (**Figure C-2;** note that heat content can be negative as it is measured against heat capacity in the oceanic water column). These changes are manifested in higher seawater temperatures worldwide.

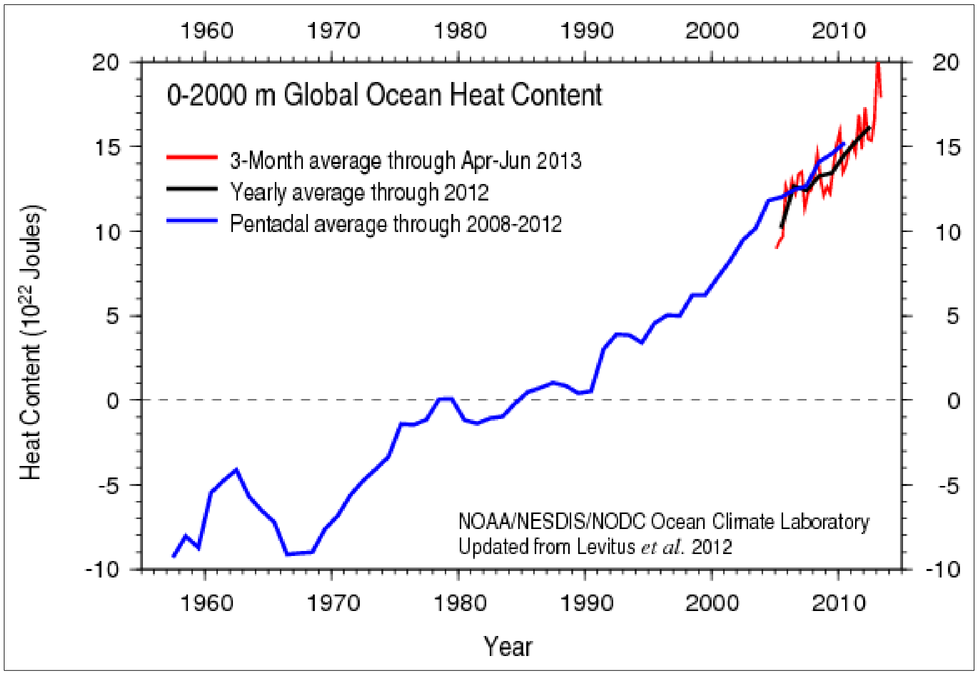


Figure C-2. Global Ocean Heat Content From ~1957 Through 2013 (From: RealClimate, 2013).

Between 1961 and 2003 global mean ocean temperature has risen by 0.10°C (32°F) in the top 700 m (2,296 ft) (Bindoff et al., 2007; USDOI, BOEM, 2012). Averaged over all land and ocean surfaces, temperatures warmed by a similar amount (0.85ºC) from 1880 to 2012 (IPCC, 2013). However, the reciprocal effects of climate change on ecosystems and change in ecosystems on climate are frequently non-uniform geographically, and non-linear in their relationships (e.g., IPCC, 2007; Blunden et al., 2011, Melillo et al., 2014). This complicates forecasts of the impacts of climate change in Outer Continental Shelf (OCS) planning areas, which encompass coastal and open ocean waters. Further, these changes are occurring simultaneously with ongoing, direct anthropogenic impacts such that it often may be difficult to separate the source of observed change arising from large-scale, global and regional trends from those induced more locally (Nicholls et al., 2007; Johnson et al., 2014). In part driven by the need to distinguish the impacts of climate change from those of other local drivers, climate model downscaling is an area of intensive study (USDOC, NOAA, Geophysical Fluid Dynamics Lab [GFDL], 2015).

Concomitant with changes in ocean heat content is SLR. The recent global SLR has been caused not only by warming-induced thermal expansion of the oceans, but also by accelerated melting of glaciers and ice sheets. Global mean sea level has risen at a mean rate of 1.8 ± 0.5 millimeters per yr (mm yr^{-1}) from 1961 to 2003 with considerable spatial and decadal-scale variability (Bindoff et al., 2007). Predictions in SLR are as much as 0.6 m (2 ft) by 2100 (Nicholls et al., 2007). The amount of relative SLR along different parts of the U.S. coast depends not only on ocean thermal expansion and ice sheet melting, but also on the changes in elevation of the land that occur as a result of subsidence or geologic uplift (Karl et al., 2009). Accelerated submergence can occur where local subsidence and SLR together promote an effective rate of sea level rise that is higher than the globally-averaged rate.

Certain areas along the Atlantic and Gulf of Mexico coasts are undergoing relatively rapid inundation and associated landscape changes because of the prevalence of low-lying coastal lands (Titus et al., 2009). Barrier islands in the northern Gulf of Mexico have been losing land and the habitats on them have changed because of decreased riverine sediment supply, combined with SLR, and intense storms (Lucas and Carter, 2010). Coastal erosion rates over the past couple of decades averaged 3.7 m yr^{-1} (12.1 ft yr^{-1}), but single storm events including Hurricane Rita eroded 39 to 49 ft (12 to 15 m) of Texas non-barrier island shoreline (Park and Edge, 2011).

Similar trends are seen in the Arctic. The coasts of the Beaufort and Chukchi Seas consist of river deltas, barrier islands, exposed bluffs, and large inlets. Inland, they are characterized by low-relief lands underlain by permafrost (Jorgenson and Brown, 2005). The combination of wind-driven waves, river erosion, SLR, and sea ice scour with highly erodible coastal land creates the potential for high erosion rates along the coasts of the Beaufort and Chukchi Seas (Proshutinsky et al., 2001; Mars and Houseknecht, 2007). In addition to erosion along the Arctic coast, storm surge flooding has converted freshwater lakes into estuaries, affecting habitat conditions (Arp et al., 2010). Although SLR and relative SLR (which accounts for the post-glacial isostatic rebound of some regions) are experienced variably among the OCS Arctic regions, Parris et al. (2012) report with very high (>90 percent) confidence that global mean sea level there will rise by at least 0.2 m (0.7 ft) and by no more than 2.0 m (7 ft) by 2100 (notably, an order of magnitude range).

Another important aspect of climate change involves a change in ocean chemistry. Ocean acidification refers to decreased potential of hydrogen (pH) of the oceans, and their buffering capacity. Acidification is caused by the uptake of atmospheric CO_2 and its subsequent reaction with seawater to form carbonic acid. Predictions of future ocean pH levels vary somewhat, but predicted decreases range from 0.14 to 0.4 pH units over the 21st century (Caldeira and Wickett, 2005; Orr et al., 2005; IPCC, 2007). Factors such as water temperatures, salinity, sea ice, and ocean mixing processes affect the amount of CO_2 absorbed by the oceans, so climate change effects on storms, river discharge, and precipitation patterns all affect ocean acidification (IPCC, 2007; 2014). These mechanisms also affect estuarine and coastal waters, although their impacts on estuarine ecosystems are not well understood because a multitude of processes affect estuarine pH levels (Feely et al., 2010).

Ocean acidification affects the ability of certain organisms to create shells or hard parts by calcification, which can be especially harmful to mollusks, corals, and certain plankton species that are crucial to oceanic food chains (Orr et al., 2005; Karl et al., 2009). However, several laboratory experiments conducted under elevated carbon dioxide conditions (pCO_2) have shown mixed calcification rates in many organisms, including some with a positive calcification response to elevated pCO_2. Results suggest organisms respond to ocean acidification using complex mechanisms (Doney et al., 2009; Ries et al., 2009). Coral reefs are calcified structures, and animals in reef habitats depend on such structures for survival. Both warm-water tropical corals, and cold-water corals are negatively impacted by ocean acidification (Royal Society, 2005). The Arctic Ocean is highly susceptible to ocean acidification resulting from increased carbon dioxide solubility, freshwater inputs, and increased primary productivity. Loss of sea ice exposes ocean water, increasing access to CO_2 enrichment and sunlight which may increase acidification and productivity, respectively (Fabry et al., 2009; Steinacher et al., 2009). In contrast, the presence of seagrasses has been suggested as a locally mitigating factor due to their ability to uptake free CO_2 and various forms of bicarbonate (Semesi et al., 2009; Hendricks et al., 2014).

Climate change predictions are based on models that simulate relevant physical processes affecting interactions among the atmosphere, oceans, and biosphere, and are driven by a variety of projected scenarios for greenhouse gas emission (Melillo et al., 2014). Global climate models generate projected changes in atmospheric, oceanic, and terrestrial surface climate variables at scales on the order of one degree latitude and longitude, insufficient for making regional-scale climate assessments. Downscaling global climate models and coupling them with more localized, regional climate models is an active area of current research (Christensen et al., 2007; Randall et al., 2007; USDOC, NOAA, GFDL, 2015). The complexity of modeling global and regional climate systems is great, so it is important to consider measures of uncertainty, typically using a multi-model ensemble approach (Krishnamurti et al., 2000). It is also important to recognize that despite new developments in climate modeling, uncertainty in climate projections can never be entirely eliminated (McWilliams, 2007), although uncertainty does not influence at least the heuristic value of the assessments. Irrespective of geographic location, changes to the physical, chemical and biological framework of these areas may begin to degrade the ability to distinguish, except in acute events where local anthropogenic effects are obvious, between the effects of climate on resource abundance and distribution and those of development projects, including instances where the change is perceptional (Papworth et al., 2009).

The IPCC has summarized climate change predictions for the next two decades and over the 21st century, using model predictions and evidence from various scientific disciplines (IPCC, 2007, 2014). The IPCC uses various scales[1] to define consistent terminology for the results of climate change projections. Uncertainty can be assessed by statistical analyses, and a 10-point scale is used for projections (with 10 being the most confident value) where uncertainty was qualitatively assessed by expert judgment. The most recent climate change projections summarized by the IPCC (2007, 2014) include some of the following, all depending on presumed mitigation strategies (e.g., degree of reduction in fossil fuel utilization, and CO_2 and other greenhouse gas emissions):

- An increase in atmospheric temperatures at different rates by global regions, ranging from 0.3 to 4.8°C (32.5 to 40.6°F) by the end of the 21st century, is predicted over a range of greenhouse gas emission scenarios;
- Warming is expected to continue to be greatest over land, and at higher latitudes;
- Model estimates of SLR vary from 0.26 to 0.85 m (0.85 to 2.8 ft) by the end of the 21st century (a notable increase since the most recent Programmatic EIS [USDOI, BOEM, 2012]), and vary substantially among geographic regions;
- Year-round reductions in Arctic sea ice, and a nearly ice-free Arctic Ocean in summer before the mid-century is likely in some projections;
- Projection models suggest ocean pH decreasing between 0.14 and 0.35 over the 21st century (note that the pH scale is logarithmic);
- It is likely that tropical cyclones will become more intense, with >66 percent confidence in this result;
- Increased precipitation is very likely to occur at high-latitudes, with >90 percent confidence in this result;
- There is high confidence that annual river runoff will increase by 10 to 40 percent at high latitudes and decrease by 10 to 30 percent in dry regions of mid-latitudes, with 80 percent confidence in these results;
- Net carbon uptake by terrestrial ecosystems is likely to peak during this century as natural carbon sequestration mechanisms reach their capacity, with >66 percent confidence in this result; and
- There is medium confidence that predicted temperature increases will result in approximately 20 to 30 percent of plant and animal species that have been assessed likely to be at an increased risk of extinction, with 50 percent confidence in this result.

Additionally, since the previous Programmatic EIS (USDOI, BOEM, 2012) there have been numerous reports on the state of the climate, and all converge in their assessment of climate change trends; three are of particular note:

- IPCC Climate Change 2014 Synthesis Report (IPCC, 2014);
- Climate Change Impacts in the United States: The Third National Climate Assessment. U.S. Global Change Research Program (Melillo et al., 2014); and
- State of the Climate in 2014 (Blunden and Arndt, 2015).

[1] "A level of confidence is expressed using five qualifiers: very low, low, medium, high and very high confidence. The following terms have been used to indicate the assessed likelihood of an outcome or a result: virtually certain 99–100% probability, very likely 90–100%, likely 66-100%, about as likely as not 33–66%, unlikely 0–33%, very unlikely 0–10%, exceptionally unlikely 0–1%. Additional terms (extremely likely 95–100%, more likely than not >50–100%, more unlikely than likely 0–<50%, extremely unlikely 0–5%) may also be used when appropriate. "(IPCC, 2014).

The IPCC (2014) report was more global in nature while the Melillo et al. (2014) report centered on the U.S. Blunden and Arndt (2015) made fewer forecasts in keeping with their focus on the current state of conditions, but provided considerable hindcast contrasts.

Detailed assessments in these reports speak to the full spectrum of climate change issues; importantly for this Programmatic EIS, they include information about climate change's influence on species composition, species abundance, and species distribution, risk, and social system responses. They also provide guidance with respect to mitigation. Conclusions of the three reports are compared in **Table C-1.**

Table C-1. Comparison of Findings Among Three Recent, Key Climate Reports.

Climate Change Attribute	IPCC, 2014	U.S. Global Change Research Program (Melillo et al., 2014)	State of the Climate in 2014 (Blunden and Arndt, 2015)
Global climate is changing due to human activities.	YES	YES	YES
Global climate is projected to continue to change over this century and beyond.	YES	YES	--
Because human-induced warming is superimposed on a naturally varying climate, the temperature rise has not been, and will not be, uniform or smooth across the country or over time.	YES	YES	YES
Across the U.S., the growing season is projected to continue to lengthen based on warming.	NO[1]	YES	--
Average U.S. precipitation has increased since 1900, but some areas have had increases greater than the national average, and some areas have had decreases.	YES	YES	YES
Increases in the frequency and intensity of extreme precipitation events are projected for all U.S. regions.	YES	YES	--
Droughts in the southwest U.S. and heat waves everywhere are projected to become more intense, and cold waves less intense everywhere.	YES	YES	--
Hurricane-associated storm intensity and rainfall rates are projected to increase as the climate continues to warm.	--	YES	--
Trends in severe storms, including the intensity and frequency of tornadoes, hail, and damaging thunderstorm winds, are uncertain and are being studied intensively.	--	YES	--
Global sea level has risen by about 0.2 m (8 inches [in]) since reliable record keeping began in 1880. It is projected to rise another 0.3 to 1.2 m (1 to 4 ft) by 2100.	YES	YES	--
The Arctic Ocean is expected to become essentially ice free in summer before mid-century.	YES	YES	--
The oceans are becoming more acidic, leading to concerns about intensifying impacts on marine ecosystems.	YES	YES	--

A (--) indicates no specific comparison could be made (topic was not directly addressed).
[1] Due to lack of precipitation.

Specifically, regarding oceans and marine resources, Doney et al. (2014) conclude:

- The rise in ocean temperature over the last century will persist into the future, with continued large impacts on climate, ocean circulation, chemistry, and ecosystems.
- The ocean currently absorbs about a quarter of human-caused carbon dioxide emissions to the atmosphere, leading to ocean acidification that will alter marine ecosystems in dramatic yet uncertain ways.
- Significant habitat loss will continue to occur due to climate change for many species and areas, including Arctic and coral reef ecosystems, while habitat in other areas and for other species will expand. These changes consequently will alter the distribution, abundance, and productivity of many marine species.
- Rising sea surface temperatures have been linked with increasing levels and ranges of diseases in humans and marine life, including corals, abalones, oysters, fishes, and marine mammals.
- Climate changes that result in conditions substantially different from recent history may significantly increase costs to businesses as well as disrupt public access and enjoyment of ocean areas.

Regarding coastal zone development, Moser et al. (2014) conclude:

- Coastal lifelines, such as water supplies, energy infrastructure, and evacuation routes, are increasingly vulnerable to higher sea levels and storm surges, inland flooding, erosion, and other climate-related changes.
- Nationally important assets in already-vulnerable coastal locations, such as ports, tourism sites, and fishing sites, are increasingly exposed to SLR and related hazards. This threatens to disrupt economic activity within coastal areas and the regions they serve, and results in significant costs related to protecting or moving these assets.
- Socioeconomic disparities create uneven exposures and sensitivities to growing coastal risks and limit adaptation options for some coastal communities, resulting in the displacement of the most vulnerable people from coastal areas.
- Coastal ecosystems are particularly vulnerable to climate change because many have already been dramatically altered by human stresses; climate change will result in further reduction or loss of the services that these ecosystems provide, including potentially irreversible impacts.
- Leaders and residents of coastal regions are increasingly aware of the high vulnerability of coasts to climate change and are developing plans to prepare for potential impacts on citizens, businesses, and environmental assets. Significant institutional, political, social, and economic obstacles to implementing adaptation actions remain.

Additionally, most if not all federal agencies are now developing and implementing strategic plans at various levels within line organizations that address societal and programmatic adaptation (e.g., Jason et al., 2015; USDOC, National Marine Fisheries Service [NMFS], 2015; USEPA, 2014]; USDOI, U.S. Fish and Wildlife Service [USFWS], 2015; U.S. Department of Defense [USDOD], 2015; and U.S. Army Corps of Engineers [USACE], 2015a).

Global climate change remains one of the most challenging factors influencing predictions of the consequences of OCS energy development for ecosystem services. Some of the challenge reflects a lack of appropriately designed and scaled experiments (Wernberg et al., 2012), and generalizations are best made at comparatively coarse scales. But even at coarse scales, there are several key physico-chemical drivers that act on ecosystem services; the consequences of changes to those drivers include changes to:

- species composition, abundance and distribution,
- coral reef condition,
- seagrass condition,
- permafrost depth changes,
- sea ice patterns,
- storm frequency and intensity,
- ocean salinity and ocean circulation, and
- prevalence of marine infectious diseases.

Species Composition, Abundance and Distribution

Effects of warming temperatures have already been seen in the form of changes in species location ranges, changes in migratory patterns and timing, changes in location and timing of reproduction, and increases in disease (Perry et al., 2005; Rosenzweig et al., 2007; Simmonds and Isaac, 2007; Collie et al., 2008; Chen et al., 2011; Cheung et al., 2015), with negative impacts for some species but also range expansions for others (e.g., Hiddink and Hoftsede, 2008). As species extend their spatial ranges, there can be negative consequences related to expansion and colonization by non-native and invasive species (Twilley et al., 2001) but on the whole it remains unclear how species, particularly those directly harvested, will fare in response to climate change (e.g., Cheung et al., 2015). In aquatic environments, climate change has the potential to affect species composition within an ecosystem according to species-specific thresholds, as well as species characteristics such as mobility, lifespan, and availability to use available resources (e.g., Chapin et al., 2000; Levinsky et al., 2007). These variations in species-specific thresholds and characteristics may result in the breakup of existing ecosystems and the formation of new ones, with unknown consequences (Perry et al., 2005; Simmonds and Isaac, 2007; Brander, 2007; Karl et al., 2009; Foden et al. 2013) but remain an area of substantial investigation (USDOC, NMFS, 2014).

Coral Reef Condition

Warmer water temperatures or increases in ultraviolet light penetration cause coral to lose their symbiotic algae, a process called bleaching. Intensities and frequencies of bleaching events have increased substantially over the past 30 yr, resulting in the death of or severe damage to about one-third of the world's shallow water corals (Karl et al., 2009). In addition to coral bleaching, there has been a rise in the occurrence of excessive algal growth on reefs, as well as an increased presence of predatory organisms, and reports of increased disease related to bacterial, fungal, and viral agents (Boesch et al., 2000; Twilley et al., 2001). New concerns have emerged regarding climate change-induced vulnerability for coral species under consideration for listing under the Endangered Species Act (ESA) (Brainard et al., 2011). However, there is emerging evidence that corals may have some adaptive potential under increasing temperature (Dixon et al., 2015), although it is unknown whether this could actually mitigate bleaching events.

Seagrass Condition

Seagrasses, like corals, exist in comparatively shallow, light-limited coastal environments. Like other plants, seagrasses directly utilize CO_2 in photosynthesis and increased ocean acidity may actually enhance their productivity (Palacios and Zimmerman, 2007). The presence of seagrass is postulated to mitigate impacts on calcareous organisms such as algae and corals in their vicinity (Semesi et al., 2009; Hendricks et al., 2014) although as in other systems, the interaction of seagrass with acidifying conditions and the outcome for associated faunal communities is complex (Garrard et al., 2014) and likely uneven.

Permafrost Depth Changes

Permafrost degradation affects terrestrial and hydrologic conditions in Arctic regions where the temperature at the top of the permafrost layer has increased by up to 3°C (37.4°F) since the 1980s, and in the Alaskan Arctic, where the permafrost base has been thawing at a rate of up to 0.04 m yr^{-1} (Lemke et al., 2007). Recent data collected in 2010 suggest that trends in permafrost warming have begun to propagate southward nearly 200 kilometers (km) (124 miles (mi]) inland from the North Slope (Richter-Menge and Jeffries, 2011). Thawing of permafrost near coastal regions is expected to result in more rapid rates of shore erosion, increases in stored-carbon releases (Schuur et al., 2009), and damage to infrastructure such as roads and pipelines (Karl et al., 2009). These effects are expected to be compounded by reduced duration and extent of shoreline protection provided by landfast ice and more exposure to ocean storms.

Chapin et al. (2014) report that permafrost temperatures in Alaska are rising, a thawing trend that is expected to continue, causing multiple vulnerabilities through drier landscape, more wildfire, altered wildlife habitat, increased cost of maintaining infrastructure, and the release of heat-trapping gases that increase climate warming. For 2014, Blunden and Arndt (2014) report: "*In higher latitudes and at higher elevations, increased warming continued to be visible in the decline of glacier mass balance, increasing permafrost temperatures, and a deeper thawing layer in seasonally frozen soil. In the Arctic, the 2014 temperature over land areas was the fourth highest in the 115-year period of record and snow melt occurred 20–30 days earlier than the 1998–2010 average. The Greenland Ice Sheet experienced extensive melting in summer 2014. The extent of melting was above the 1981–2010 average for 90% of the melt season, contributing to the second lowest average summer albedo over Greenland since observations began in 2000 and a record-low albedo across the ice sheet for August. On the North Slope of Alaska, new record high temperatures at 20-m depth were measured at four of five permafrost observatories.*" Further, "*Permafrost temperatures measured in the Arctic vary from 0°C in the southern portion of the discontinuous zone to about –15°C in the high Arctic (Romanovsky et al., 2010; Christiansen et al. 2010). Permafrost has warmed over the past two to three decades, and generally continues to warm across the circumpolar north. Record high temperatures were observed in 2013–14 in the Alaskan Arctic and the Canadian Archipelago (Romanovsky et al. 2013, 2014).*" These observations reinforce previous ones (USDOI, BOEM, 2012).

Sea Ice

The presence of sea ice and landfast ice in the Arctic creates a productive marine ice biome essential for marine animals to survive and flourish, and for support of traditional subsistence communities (e.g., Berkes and Jolly, 2001; Simmonds and Isaac, 2007; Arp et al., 2010). For marine animals, these environments provide hunting, resting, and birthing platforms along the ice-water interface, generate local upwelling responsible for high productivity in polynyas, and release large quantities of algae growing beneath the ice surface into the food chain at ice melt (ACIA, 2005, 2010). Polar bear (*Ursus maritimus*) populations are strongly correlated with regional characteristics of sea ice (e.g., thickness, stability) and vary seasonally and with respect to specific requirements for reproduction (Durner et al., 2004). Alaska Native people from coastal villages in northwestern Alaska and on the North Slope use sea ice for hunting and fishing grounds, as well as seasonal whaling camps as part of their subsistence lifestyle (Braund and Kruse, 2009). The greatest threat to the sea ice biome is loss of sea ice due to climate change. Sea ice extent, mainly observed using remote sensing methods, has decreased at a rate of approximately 3 percent per decade starting in the 1970s, with larger decreases occurring in summer months (Parkinson, 2000). The areal extent of multi-year sea ice has decreased at a rate of nearly 9 to 12 percent per decade since the 1980s (Comiso, 2002; Perovich et al., 2010), but other studies have shown a decrease in the areal extent of multi-year ice area of 42 percent from 2005 to 2008 (Kwok and Cunningham, 2010). In September 2014, Arctic minimum sea ice extent was the sixth lowest since satellite records began in 1979. The eight lowest sea ice extents during this period have occurred in the last eight years. Conversely, in the Antarctic, sea ice extent rebounded from a declining trend and set several new records in 2014, including record high monthly mean sea ice extent each month from April to November. On 20 September, a record large daily Antarctic sea ice extent of 20.14×10^6 km^2 occurred (Blunden and Arndt, 2014) although much of this is likely new, thinner ice than historically observed. These observations reinforce the consensus that climate change effects will not be uniform in their distribution.

Storm Frequency and Intensity

Regional weather conditions are influenced by modal climatic patterns such as the El Niño–Southern Oscillation (ENSO), Arctic Oscillation (AO), North Atlantic Oscillation (NAO), and the Pacific Decadal Oscillation (PDO). These act as connection pathways between regional atmospheric conditions and the world's oceans (NRC, 1998; Liu and Alexander, 2007). Major storms in low- to mid-latitude regions including cyclones, hurricanes, and typhoons are controlled largely by the ENSO phase (Trenberth et al., 2007). In the Northern Hemisphere, there is a general northward shift in cyclone activity that is correlated with AO and NAO phases (ACIA, 2005, 2010). Climate change affects water temperatures and wind patterns that interact to either enhance or work against storm formation, making it difficult to predict climate change effects on major storm events (Karl et al., 2009). However, a number of studies have concluded that cyclonic activity has changed over the second half of the 20^{th} century with evidence suggesting that since the 1970s there has been a substantial upward trend toward longer-lasting and more intense storms (Trenberth et al., 2007). Moser et al. (2014) report that there has been an overall increase in storm activity near the U.S. northeast and northwest coastlines since about 1980 (Vose et al., 2012). Winter storms have increased slightly in frequency and intensity and their storm tracks have shifted northward (Wang et al., 2006). The most intense tropical storms have increased in intensity in the last few decades (Wang et al., 2012). Future projections suggest increases in hurricane rainfall and intensity, a slight decrease in the frequency of tropical cyclones, and possible shifts in storm tracks, although storm track forecasting is particularly unreliable. A challenge of increased fluctuations and frequency of extreme events is for resource managers to separate those effects from those of coastal development activities, which will require greater utilization of extreme event statistics (Gaines and Denny, 1993).

Ocean Salinity and Ocean Circulation

Large-scale trends in ocean salinity suggest certain regions have been experiencing changes in salinity that in combination with the warming of the atmosphere and oceans can change the dynamic properties of the ocean circulation patterns. Ocean salinities are changing on a decadal scale (Durack et al., 2012). The previous Programmatic EIS (USDOI, BOEM, 2012) concluded there was no clear evidence to suggest significant changes to major ocean circulation patterns as a result of climate change (Bindoff et al., 2007). However, there have been regional studies that suggest potential mechanistic changes to ocean circulation. For example, Bakun (1990) presented evidence on the effects of altered wind patterns that could enhance coastal upwelling along the western coast of the United States, which in turn could increase productivity in that region as nutrient-rich bottom water ascends to the ocean surface. Similarly, Hilton et al. (2008) concluded that increased salinity in the Chesapeake Bay was the result of SLR and associated changes in tidal intrusion from the ocean. There also has been interest in understanding the effect of increased freshwater inputs from the Greenland Ice Sheet with respect to effects on the (AMOC), changes which could drastically affect SLR and climate conditions in the North Atlantic (Church, 2007; Rabe et al., 2011). One of the largest obstacles for understanding climate change effects on ocean currents is the lack of long-term measurements, which makes it difficult to decipher climate change response from inter-decadal variability (Bryden et al., 2003; Melillo et al., 2014). Blunden and Arndt (2014) reported sea surface salinity trends (Johnson et al., 2015) over the past decade indicating that salty regions grew saltier while fresh regions became fresher, suggesting an accelerated hydrological cycle over the ocean as a result of global warming. As in previous years, these patterns are reflected in 2014 subsurface salinity anomalies as well (Boyer et al., 2014).

Marine Infectious Diseases

The prevalence of these diseases is extremely difficult to ascribe to any one particular governing factor such as a change in temperature, precipitation, or runoff. However, the confluence of effects on increases in marine infectious disease has long been recognized (Harvell et al., 2004). The general status of dealing with climate change-mediated disease is preliminary, relying on adaptive management strategies that emphasize forecasting and detection (Burge et al., 2014).

National Security

Climate change is also recognized to have consequences for national security in the form of resource limitations, frequency of climate-driven emergencies, and human crises arising from food and water limitations both domestically and abroad. Needs for extractable resources available in the program areas may increase in response to some crises while challenges to coastal infrastructure needed to support resource utilization increase. Recent reports by the White House (2015) and Navy through the National Academy of Sciences (National Academy of Sciences, NRC, Naval Studies Board, 2011) provide expansive description of the cascading effects of climate change on national security.

1.1.1. Alaska Region

1.1.1.1 Beaufort Sea and Chukchi Sea Planning Areas

This section draws heavily from two recent sources: Blunden and Arndt (2014) and Melillo et al. (2014), who provided updated climactic summaries, and syntheses of climate effects and outcomes, respectively.

The impacts of climate change occur disproportionately in the Arctic and include warming ocean temperatures, increasing ocean acidification, reductions in sea ice, permafrost thawing, and coastal erosion, which all affect terrestrial, coastal, and marine ecosystems (Hopcroft et al., 2008). Climate change-induced warming is the primary driver of resource and associated cultural change in the Arctic. Jefferies and Richter-Menge (2014) report that, although there are regional and seasonal variations in the state of the Arctic environmental system, it continues to respond to long-term upward trends in air temperature. Over Arctic lands, the rate of warming is more than twice that of the lower latitudes (Jefferies and Richter-Menge, 2014) and nearly double that of global means (IPCC, 2007, 2014).

For example, the mean annual Arctic land surface air temperature for 2014 was +1.1°C (34°F) relative to the 1981 to 2010 Arctic average, the fourth warmest in a record beginning in 1900 (Overland et al., 2014). Arctic amplification, due to feedbacks involving loss of sea ice and snow cover, changes in land ice and vegetation cover, and atmospheric water vapor content accounts for the rapid Arctic warming (Serreze and Barry, 2011). Natural variability promotes year-to-year and regional differences in air temperature, but the magnitude and Arctic-wide extent of the long-term temperature increase, and particularly the early 21st century increase, are major indicators of global warming (Overland, 2009; Jeffries et al., 2013). However, as noted in BOEM (2012), the Arctic climate system is complex. Climatic conditions there experience strong decadal variability in relation to large-scale, varying climatic patterns such as the AO, PDO, and NAO (ACIA, 2005, 2010). A recent model suggests that Arctic regions are nearing a threshold, where amplified greenhouse warming is likely to exceed varying decadal patterns (Serreze and Francis, 2006). Nonetheless, the spectrum of changes in Alaskan and other high-latitude terrestrial ecosystems where wildfires (French et al., 2004) and methane release (Walter et al., 2006) are increasing jeopardizes efforts by society to use ecosystem carbon management to offset fossil fuel emissions (Schuur and Abbott, 2011; MacDougall et al., 2012).

One of the most important changes in the Arctic environment relevant to OCS development is the ongoing reduction in sea ice. Within the Arctic, impacts of climate change already have been recorded. There has been a progressive, yearly decline in the thickness and extent of Arctic sea ice. **Figures C-3** and **C-4** compare Arctic sea ice extent in 1992 versus 2012. The retreat of ice has created navigation routes through the Northwest Passage and the Northern Sea Route (**Figure C-4**). Arctic sea ice reached a record minimum of 3.61 million km^2 (1.39 million mi^2) in September 2012 (National Snow and Ice Data Center [NSIDC], 2015).

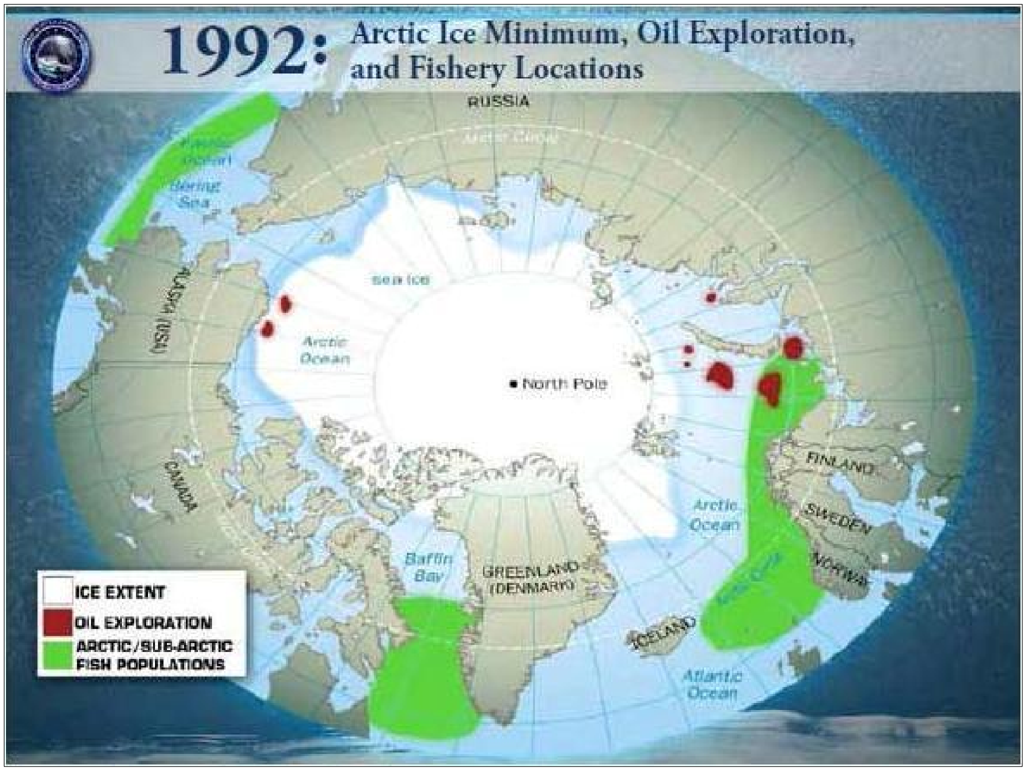


Figure C-3. Sea Ice Extent and Arctic Resources and Activities, 1992 (From: USCG, 2015).

Figure C-4. Sea Ice Extent and Arctic Resources and Activities, 2012 (From: USCG, 2015).

Reductions in sea ice increase the amount of the sun's energy that is absorbed by the ocean. This leads to a self-reinforcing cycle, because the warmer ocean melts more ice, leaving more dark open water that absorbs even more heat. As the sea ice retreats in summer, sea surface temperature (SST) in all of the marginal Arctic Ocean seas is increasing (Timmermans and Proshutinsky, 2014). The most significant linear trend has been in the Chukchi Sea, where SST increased at a rate of 0.5°C (32.9°F) per decade (decade^{-1}) over the period 1982 to 2010. In summer 2014, the largest SST anomalies, as much as 4°C (32.7°F) above the 1982 to 2010 average, occurred in the Barents Sea and in the Bering Strait–Chukchi Sea region. In autumn and winter, the flux of this heat is back to the atmosphere (ACIA, 2005, 2010). This is a key driver of the observed increases in Arctic air temperatures. This strong warming linked to ice loss may influence atmospheric circulation and patterns of precipitation, both within and beyond the Arctic (ACIA, 2005, 2010; Overland and Wang, 2010; Porter et al., 2012). There is growing evidence that this has already occurred, with observations of more evaporation from the ocean, which increases water vapor in the lower atmosphere and autumn cloud cover north and west of Alaska (Wu and Lee, 2012).

Sea ice cover is usually measured using three metrics: ice extent, age of the ice, and ice thickness. Sea ice extent is used as the basic description of the state of the Arctic sea ice cover. Arctic summer sea ice is receding faster than previously projected and is expected to virtually disappear before mid-century (Chapin et al., 2014).

Arctic sea ice extent and thickness have declined substantially, especially in late summer (September). There is now only about half as much sea ice as at the beginning of the satellite record in 1979, and the seven Septembers with the lowest ice extent all occurred in the past seven years (Maslowski et al., 2012) and in September 2014, minimum sea ice extent was the sixth lowest since satellite records began in 1979. Moreover, the eight lowest sea ice extents during this period have all occurred in the last eight years (2007 to 14) (Perovich et al., 2014). Sea ice loss appears to be accelerating; through the period of satellite observation (1979 to 2014), the rate of summer sea ice loss was 13.3 percent decade^{-1} and coincided with similar rates of Northern Hemisphere snow loss.

As sea ice declines, it becomes thinner; and therefore, more vulnerable to further melting (Stroeve et al., 2012). Models that best match historical trends predict northern waters that are virtually ice-free in late summer by the 2030s (Wang and Overland, 2009, 2012). Nonetheless, within the general downward trend in sea ice, there will be periods with both rapid ice loss and temporary recovery making it challenging to predict short-term changes in ice conditions (Tietsche et al., 2011).

Vessel activity in the Arctic has increased with retreating sea ice. Expanding commercial ventures in the Arctic have increased maritime traffic in the Bering Strait. From 2008 to 2012, traffic through the Bering Strait increased by 118 percent (USCG, 2013a), and comprised a broad range of vessels, including icebreakers, research vessels, oil industry vessels (but see the recent decision by Royal Dutch Shell to cease Arctic oil and gas exploration [Royal Dutch Shell, 2015]), ore carriers, coastal resupply ships, cruise ships, recreational and adventurer vessels, and commercial fishing boats. With increased traffic comes an increased potential for search and rescue, water pollution, illegal fishing, and infringement on the U.S. Exclusive Economic Zone (EEZ).

Retreat of sea ice will increase impacts on coastal areas from storms. Furthermore, coastlines where permafrost has thawed are more vulnerable to erosion from wave action, which can affect erosion rates as well as change freshwater lakes into estuarine habitats (Mars and Houseknecht, 2007; Arp et al., 2010). Further loss of sea ice and increasing permafrost thawing could accelerate erosion rates, resulting in rapid loss of many Arctic barrier islands (Stutz and Pilkey, 2011) with associated erosion of what were lagoon shorelines. Recently in the Beaufort Sea, Arctic barrier islands eroded at rates three to four times faster that of islands off the continental U.S. (Stutz and Pilkey, 2011). A comparison made using aerial photos has revealed total erosive losses up to 1,500 feet (ft) (457 meters [m]) over the past few decades along some stretches of the Alaskan coast (Alaska Regional Assessment Group, 1999). At Barrow, Alaska, coastal erosion has been measured at the rate of 1 to 2.5 m yr^{-1} (3 to 8 ft yr^{-1}) since 1948 (ACIA, 2005, 2010), and this has severely impacted the community (ACIA, 2010). Maximum coastal erosion rates of up to 13.3 m y^{-1} (44 ft yr^{-1}) occurred near Cape Halkett and Cape Simpson between 1980 and 2000 (Ping et al., 2011).

The age of sea ice serves as an indicator of ice's physical properties, particularly thickness. Older ice tends to be thicker and thus more resilient to changes in atmospheric and oceanic forcing. As the amount of newer and seasonal ice declines, the fraction of oldest (≥4 yr old) ice has been increasing, comprising 10.1 percent of the March 2014 ice cover, up from 7.2 percent the previous year. Despite increasing proportions of the older ice, there still was much less ice including that of the oldest and thickest ice in 2014 than in 1988. In the 1980s the oldest ice made up 26 percent of the ice pack (Perovich et al., 2014). Loss of sufficiently thick sea ice can have substantial impact on various marine mammal groups that utilize sea ice for resting and reproduction.

Since 1967, *in situ* observations of warmer temperatures have been accompanied by observations of declining snow cover. Additionally, snow melt is now reported to have begun 20 to 30 days earlier than the 1998 to 2010 average (Overland et al. 2014). Overland et al. (2014) suggest that emerging evidence suggests Arctic warming is driving synchronous pan-Arctic responses in the terrestrial and marine cryosphere that are strengthening over time. Reductions in snow cover also contribute to the ice-albedo feedback mechanism, and alter the chemistry of nearshore waters through reduced glacier growth and ice production.

Alaska differs from most of the rest of the U.S. in having permafrost – frozen ground that restricts water drainage and therefore strongly influences landscape water balance and the design and maintenance of infrastructure. Along with increased atmospheric temperatures and reduced snow cover, permafrost temperatures in Alaska are rising, reflecting a thawing trend that is expected to continue, causing multiple vulnerabilities through drier landscapes, more wildfire, altered wildlife habitat, increased cost of maintaining infrastructure, and the release of heat-trapping gases that increase climate warming (Chapin et al., 2015) (CO_2 and methane, the latter having the capacity to contribute 28 to 36 times (USEPA, 2015c) the global warming potential per unit ton of CO_2).

Permafrost near the Alaskan Arctic coast has warmed substantially. Immediately east of the Chukchi Sea, on the North Slope of Alaska, new record high temperatures at 20-m (66-ft) depth were measured at four of the five permafrost observatories (Romanovsky et al., 2014). Permafrost temperature at the 20 m (66 ft) depth has increased between 0.18° and 0.56°C (32.3 and 33°F) decade^{-1} since 2000 on the North Slope and approximately 1.1°C (34°F) at 1 m (3.3ft) depth since the mid-1980s (Romanovsky et al., 2014), reflecting what is happening to permafrost temperature on a pan-Arctic scale (Melillo et al., 2014). In 2014, new record high temperatures at 20 m (66 ft) depth were measured at all permafrost observatories on the North Slope of Alaska (Romanovsky et al., 2014). Changes in permafrost temperatures at 20-m (66-ft) depth typically lag about one year behind the changes in surface temperatures. The summer of 2013 was particularly warm on the North Slope and thus contributed to the temperature increase at 20-m (66-ft) depth.

In Alaska, 90 percent of land is underlain by permafrost, and of this, more than 70 percent is vulnerable to subsidence upon thawing because of varying ice content (Romanovsky et al., 2008; USDOI, USGS, 2012). Thaw is already occurring in interior and southern Alaska and in northern Canada, where permafrost temperatures are near the melting point (French, 2011). Models project that permafrost in Alaska will continue to thaw (Euskirchen, et al. 2006; Avis et al., 2011) and some models project that near-surface permafrost will be lost entirely from large parts of Alaska by the end of the century (Jafarov et al., 2012).

Changes in permafrost have caused failure of buildings and costly increases in road maintenance in Alaska due to their damage (Alaska Regional Assessment Group, 1999; Hinzman et al., 2005). Present costs of thaw-related damage to structures and infrastructure in Alaska have been estimated at $35 million per year (yr^{-1}) (NAST, 2000). A continued warming of the permafrost is likely to increase the severity of permafrost thaw-related problems. Thawing of any permafrost increases groundwater mobility, reduces soil bearing strength, and increases the susceptibility to erosion and landslides. Thawing could disrupt petroleum exploration and production by shortening the availability of time for minimal-impact operations on ice roads and pads (ACIA, 2005, 2010).

Uneven sinking of the ground in response to permafrost thaw is estimated to add between $3.6 and $6.1 billion (10 to 26 percent) to current costs of maintaining public infrastructure such as buildings, pipelines, roads, and airports over the next 20 years (Larsen et al., 2008). Further, ground subsidence will disrupt community water and sewer services with potential negative consequences for human health (Brubaker et al., 2011). Oil and gas exploration is allowed on tundra only about half as long during a year now as in the 1970s as a result of permafrost vulnerability (Hinzman et al., 2005).

Changes in terrestrial ecosystems in Alaska and the Arctic may be influencing the global climate system. Permafrost soils throughout the entire Arctic contain almost twice as much carbon as the atmosphere (Schuur and Abbott, 2011). Schurr and Abbott (2011) state: "*As soils defrost, microbes decompose the ancient carbon and release CH_4 and carbon dioxide. Not all carbon is equally vulnerable to release: some soil carbon is easily metabolized and transformed to gas, but more complex molecules are harder to break down. The bulk of permafrost carbon will be released slowly over decades after thaw, but a smaller fraction could remain within the soil for centuries or longer. The type of gas released also affects the heat-trapping potential of the emissions. Waterlogged, low-oxygen environments are likely to contain microbes that produce CH_4 — a potent greenhouse gas with about 25 times more warming potential than CO_2 over a 100-year period. However, waterlogged environments also tend to retain more carbon within the soil. It is not yet understood how these factors will act together to affect future climate*."

With changes in temperatures and reflectivity, cascading environmental changes will influence the abundance and distribution of flora and fauna. Ice edges are biologically productive systems in which ice algae form the base of the food chain, which has implications for higher trophic levels (Moline et al., 2008). The sea ice algae are crucial to Arctic cod (*Boreogadus saida*), which is an important species to the diets of seabirds and marine animals in Arctic regions (Bradstreet and Cross, 1982; Gradinger and Bluhm, 2004). As ice melts, there is concern that there will be loss of prey species of marine mammals, such as Arctic cod and amphipods, which are associated with ice edges, and these impacts could propagate through food webs associated with the sea ice biome (ACIA, 2005, 2010).

Loss of sea ice, especially multi-year ice that lasts through summer months, could cause large-scale changes in marine ecosystems and could threaten populations of marine mammals such as polar bears, walruses (*Odobenus rosmarus*), and seals that depend on the ice for habitat, hunting, reproduction and transportation (Fay, 1982; Boesch et al., 2000; NAST, 2000; Durner et al., 2004; Hopcroft et al., 2008; Karl et al., 2009). With respect to the impacts of climate change on Arctic biota, there have been reported changes in abundance, range shifts, growth rates, behavior, and community dynamics for both terrestrial ?and marine species (Belkin, 2009; Mueter et al., 2009; Wassmann et al., 2011). Polar bears are one of the most sensitive Arctic marine mammals to climate warming because they spend most of their lives on sea ice (Ladrie et al., 2008). Seals and polar bears regularly also use landfast sea ice, particularly susceptible to climate warming, as habitat (Boesch et al., 2000). In Hudson Bay, where there is the most studied Arctic polar bear population, sea ice is now absent for three weeks longer during a year than it was just a few decades ago, resulting in less body fat per bear, and reduced survival of both the youngest and oldest bears (Stirling et al., 1999). The polar bear population is now estimated to be in decline (Regehr et al., 2007), and is projected to be in jeopardy (Molnar et al., 2011). Similar polar bear population declines are projected for the Beaufort Sea region (Hunter et al., 2010).

Walruses similarly depend on sea ice as a platform for giving birth, nursing, and resting between dives to the seafloor, where they feed (Fay, 1982). In recent years, summer sea ice in the Chukchi Sea retreated over waters that were too deep for walrus to feed (Douglas, 2010), and large numbers of walrus abandoned the ice and came ashore. This movement to land first occurred in 2007 and has happened three times since then, suggesting a threshold change in walrus ecology. Such high concentrations of animals can increase competition for food, and can lead to stampedes when animals are startled, trampling calves (Fay and Kelly, 1980).

Alaska also contains virtually all glaciers in the U.S. and most are shrinking substantially. This trend is expected to continue and has implications for hydropower production, ocean circulation patterns, fisheries, and global SLR. Alaska is home to some of the largest glaciers, and these suffer the fastest loss of glacial ice on Earth (Larsen et al., 2007; Berthier et al., 2010; Jacob et al., 2012).

Glaciers supply about half of the total freshwater input to the Gulf of Alaska (Neal et al., 2010). Glacial retreat currently increases river discharge and hydropower potential in south-central and southeast Alaska, but over the longer term might decrease water input to reservoirs, and therefore reduce hydropower resources. Note that approximately 21 percent of Alaska’s electricity is from hydropower (Susitna-Watana Hydro, 2015).

Rapid ice loss is primarily a result of rising temperatures (Arendt et al., 2002, 2009), and will influence SLR (Jacob et al., 2012). Glaciers continue to respond to climate warming for years to decades after warming ceases, so ice loss is expected to continue, even if air temperatures were to remain at current levels. The global decline in glacial and ice-sheet volume is predicted to be one of the largest contributors to global SLR during this century (Maier et al., 2005; Radić and Hock, 2011).

Current and projected increases in Alaska’s ocean temperatures and changes in ocean chemistry are expected to alter the distribution and productivity of Alaska’s marine fisheries, which lead the U.S. in commercial value (Chapin et al., 2015). Water from glacial landscapes is an important source of organic carbon, phosphorus, and iron that contribute to high coastal productivity, so changes in these inputs could alter critical nearshore fisheries (Hood et al., 2009; Fellman et al., 2010).

Ocean fisheries in particular are highly vulnerable to changes in climatic conditions such as sea temperature and sea ice conditions (Karl et al., 2009), and fisheries in the Alaska region have experienced decadal-scale variability in climate due to modal patterns of oceanic and atmospheric interactions (Schwing et al., 2010). For example, Pacific salmon (*Oncorhynchus* spp.) populations have shown decadal variability over the past 300 years, which spans the timeframe before and after commercial fishing, suggesting the strong coupling of oceanic conditions and salmon populations (Finney et al., 2000). In 1977, warmer sea surface temperatures and reduced sea ice conditions generated a “regime shift” in the fisheries of the Gulf of Alaska that carried over into the 1980s, producing large salmon, pollock, and cod populations with a reduction in populations of forage fishes (Boesch et al., 2000; NAST, 2000).

The changing temperature and chemistry of the Arctic Ocean and Bering Sea are likely altering their role in global ocean circulation and their service as carbon sinks for atmospheric CO_2 respectively, although the importance of these changes in the global carbon budget remains unresolved. The North Pacific Ocean is particularly susceptible to ocean acidification (USDOC, NOAA, 2010). As ocean acidity increases, it may have potentially widespread impacts on the marine food web, including commercially important species.

But taking all prospective climate change-induced alterations (ocean acidification, rising ocean temperatures, declining sea ice), and other environmental changes into account, these will all interact to affect the location and abundance of marine fish, including those that are commercially important, those used as food by other species, and those used for subsistence. These changes have allowed some near-surface fish species such as salmon to expand their ranges northward along the Alaskan coast (NRC, 2011). In contrast, warming may cause reductions in the abundance of some species, such as pollock, in their current ranges in the Bering Sea (Mueter et al., 2011), and reduce the health of juvenile sockeye salmon, potentially resulting in decreased overwinter survival (Farley et al., 2005). Similar changes are expected for numerous species globally (Foden et al., 2013).

Overall habitat extent is expected to change as well, though the degree of the range migration will depend upon the life history of particular species. For example, reductions in seasonal sea ice cover and higher surface temperatures may open up new habitat in polar regions for some important fish species, such as cod, herring, and pollock (Loeng et al., 2005). However, continued presence of cold bottom-water temperatures on the Alaskan continental shelf could limit northward migration into the Chukchi Sea off northwestern Alaska and the northern Bering Sea (Sigler et al., 2011). If ocean warming continues, it is unlikely that current fishing pressure on pollock can be sustained (Hunt et al., 2011). Higher temperatures also are likely to increase the frequency of early Chinook salmon migrations, making management of the fishery by multiple user groups more challenging (Mundy et al., 2011).

However, current trends of increased freshwater inputs, increased ultraviolet radiation, warmer SSTs, ocean acidification, and reduced sea ice also all are driving changes in biodiversity across trophic levels for marine and freshwater fish of the Alaskan region. There are both positive and negative effects on various fish populations depending on their tolerance levels and their ability to adapt to changing habitats (Reist et al., 2006; Anisimov et al., 2007; Bates and Mathis, 2009; NRC, 2011; Chapin et al., 2015). In addition to temperature and sea ice changes, permafrost thawing and alterations to terrestrial hydrology have the potential to increase sediment and nutrient availability in estuarine and nearshore habitats, which have a mixture of positive and negative impacts on marine and anadromous fish populations (ACIA, 2005, 2010; Hopcroft et al., 2008).

Alaska's Native Peoples, who are the most numerous residents of this region, depend economically, nutritionally, and culturally on hunting and fishing for their livelihoods (Kruse, 1991; Huntington et al., 2005; Cochran et al., 2013). Hunters speak of thinning sea and river ice that makes harvest of wild foods more dangerous, changes to permafrost that alter spring run-off patterns, a northward shift in seal and fish species, and rising sea levels with more extreme tidal fluctuations (Davis, 2012; McNeely, 2012). Responses to these changes are often constrained by regulations (McNeely, 2012). Impacts of climate change on river ice dynamics and spring flooding are threats to river communities but are complex, and trends have not yet been well documented (Lindsey, 2011).

Alaska Native subsistence communities have adapted to climate variability in the past, but current warming trends may produce uncharacteristic and extreme environmental conditions that can have adverse effects (Berkes and Jolly, 2001; Anisimov et al., 2007). Multi-year sea ice loss, permafrost loss, and SLR may alter traditional hunting locations and shift game patterns and quality, travel routes, and inter-community trading and social mechanisms (Alaska Regional Assessment Group, 1999; ACIA, 2005, 2010). In addition to such impacts of climate change, Alaska Native subsistence communities have been adapting to economic development and modernization occurring in Arctic regions (ACIA, 2005, 2010; Braund and Kruse, 2009). Alaska Native subsistence communities have experienced and are currently experiencing impacts on subsistence activities caused by a combination of environmental, social, and cultural changes. The Alaska Native subsistence communities will find it more difficult to adapt or relocate than they did in the past because most now live in established communities (ACIA, 2005, 2010).

Major food sources are under stress due to many factors, including lack of sea ice for marine mammals (Galloway et al., 2009). Thawing of near-surface permafrost beneath lakes and ponds that provide drinking water cause food and water security challenges for villages. Sanitation and health problems also result from deteriorating water and sewage systems, and ice cellars traditionally used for storing food are thawing. Warming also releases human-caused pollutants from thawing permafrost, such as poleward-transported mercury and organic pesticides. Warming brings new diseases to Arctic plants and animals, including subsistence food species, posing new health challenges, especially to rural communities (McLaughlin et al., 2005). Positive health effects of warming include a longer growing season for gardening and agriculture (Weller, 2005).

Development activities in the Arctic (for example, oil and gas, minerals, tourism, and shipping) are of concern to indigenous communities, from both perceived threats and anticipated benefits (Kruse, 1991). Greater levels of industrial activity might alter the distribution of species, disrupt subsistence activities, increase the risk of oil spills, and create various social impacts. At the same time, some authors posit that development provides economic opportunities, if guided appropriately (Baffrey and Huntington, 2010).

Arctic communities have initiated studies to account for potential damage to local infrastructure imposed by climate change (Bronen, 2013). For example, the community in Kivalina has experienced severe erosion from sea storms, which occur predominantly in late summer or fall. These storms can cause a sea level rise of approximately 3 m (10 ft) or more, and when combined with high tides, the storm surge can be accompanied by waves that contain ice. The village of Kivalina therefore initiated studies to determine the cost of relocating the village and its associated infrastructure (General Accounting Office [GAO], 2003). Other communities within the Arctic that must adapt to address flooding and erosion concerns include, but are not limited to, Point Hope, Barrow, Kaktovik, Kotzebue, and Shishmaref (GAO, 2003). However, as noted previously, post-glacial rebound and tectonic effects in Alaska often result in the land being uplifted more rapidly than sea level is rising (Freymueller et al., 2008).

1.1.1.2. Cook Inlet Planning Area

One of the primary ecological drivers within Cook Inlet is climate, as it helps shape the land, as well as influencing ground cover. Current evidence suggests that Alaska's climate is undergoing an unusual degree of change; records, for instance, show that temperatures in Anchorage have increased approximately 2.2°C (36°F) over the last 41 years and up to 4.5°C (40.1°F) in winter months since the 1960s. Estimates for this area of Alaska indicate that in the coming years, precipitation will increase slightly in the fall and winter, and by up to 10 percent in the spring and summer (Nature Conservancy, 2003). Climate change in these regions is associated with the loss of ice-cover and permafrost, as well as a slow rise in sea level; these changes in turn influence infrastructure and land use planning decisions. However, post-glacial rebound and tectonic effects in Alaska often result in the land being uplifted more rapidly than sea level is rising (e.g., Cook Inlet and the Kenai Peninsula are rising 2 to 4 times faster than sea level, whereas Prince William Sound will experience rapidly rising sea level in the absence of rebound; Freymueller et al., 2008).

In response to these potential changes, communities within Cook Inlet have adapted new strategies, including analyses to further evaluate the vulnerability of the existing infrastructure. In 2007, for instance, the Kenai Peninsula Borough (KPB) adopted a resolution to address the local climate change impacts, which indicated the need for a borough-wide plan in order to address "both short-term and long-term impacts to the natural environment and surrounding communities, including increased risks of forest fire, floods, and coastal erosion" (KPB, 2008).

1.1.2. Gulf of Mexico Region

Throughout the Gulf of Mexico and adjacent waters, climate change is expected to affect not only coastal ecosystems, including the comparatively shallow waters of the northern Gulf of Mexico and their associated extractable living resources, but also adjacent uplands and watersheds (notably the Mississippi Basin which drains 41 percent of the conterminous U.S. [USACE, 2015b]), offshore areas, including those that border other countries, and human use sectors such as industry and recreational uses. For example, coastal Louisiana provides an unstable land surface for development in many areas because of ongoing subsidence, exposure to tropical storms and hurricanes, and upstream and downstream alterations in hydrology and sediment load and redistribution processes associated with the Mississippi River. Even without considering the effects of climate change, the landscape of coastal Louisiana is expected to undergo considerable change during the life of the Program, as a result of these processes.

Climate change in the Gulf of Mexico is expected to accelerate changes in these coastal ecosystems, forests, air and water quality, fisheries, and business sectors such as industry and energy (Ning et al., 2003). The Gulf of Mexico region has experienced increasing atmospheric temperatures since the 1960s, and from 1900 to 1991 SSTs have increased in coastal areas, while having decreased in offshore regions for undetermined reasons (Twilley et al., 2001). In addition to temperature changes, SLR impacts the U.S. coast of the Gulf of Mexico with results that include loss of coastal wetland and mangrove habitats, salt water intrusion into coastal aquifers and forests, and increasing shoreline erosion (Williams et al., 1999; Pendleton et al., 2010). SLR associated with climate change is occurring in combination with altered hydrology and land subsidence. Together, these factors result in relative SLR ranging between 0.002 m yr^{-1} along the coast of Texas and up to 0.01 m yr^{-1} along the Mississippi River Delta (Twilley et al., 2001); these rates have not changed substantively since the previous Programmatic EIS (USDOI, BOEM, 2012). However, because of differing rates of subsidence, even over comparatively small distances within the Gulf of Mexico, relative SLR varies substantially (USDOI, USGS, 2015a).

Climate models generally predict a temperature rise in the Gulf of Mexico coastal states this century; however, predictions of precipitation are more problematic due to model uncertainties (Karl et al., 2009). Predictions of precipitation among various modeling studies for the Gulf of Mexico region have generally predicted a slight decrease in precipitation in coastal areas, as well as more intense rainfall events and longer periods of drought (i.e., high variability; see recent '1000 year rain' in Charleston, S.C.) but models vary widely in upland areas, which affect river discharges (Mulholland et al., 1997; Boesch et al., 2000; Twilley et al., 2001). Recently, Wahl et al. (2014) concluded that changes in the Gulf of Mexico seasonal sea level cycle have almost doubled the risk of hurricane induced flooding associated with SLR since the 1990s for the Gulf of Mexico's eastern and northeastern coastlines.

Significant increases or decreases in precipitation and river runoff would affect salinity and water circulation, as well as water quality in the Gulf of Mexico. Increased runoff likely would deliver more nutrients (such as nitrogen and phosphorous) to estuaries, increase the stratification between warmer, fresher and colder, saltier water, potentially lead to eutrophication of estuaries, and increase the potential for harmful algal blooms that can deplete dissolved oxygen levels in seawater (Justic et al., 1996; Karl et al., 2009). Reductions of freshwater flows in rivers or prolonged drought periods could substantially reduce biological productivity in Mobile Bay, Apalachicola Bay, Tampa Bay, and the lagoons of Texas, and could increase the salinity in coastal ecosystems, resulting in a decline in mangrove and sea grass habitats (Twilley et al., 2001). Decreased runoff also could diminish estuarine flushing, decrease the size of estuarine nursery zones, and allow predators and pathogens to increase (Boesch et al., 2000) as these effects are now being observed in the marine environment worldwide (Harvell et al., 2004; Burge et al., 2014).

SLR along parts of the northern Gulf of Mexico coast are as high as 0.01 m yr^{-1}, much greater than globally averaged rates (Twilley et al., 2001; IPCC, 2007), with models examining the impacts of SLR at magnitudes ranging from 0.7 to 2.0 m (2.3 to 6.6 ft) by 2100 (Geselbracht et al., 2015). Moreover, temporal variations of the seasonal sea level harmonics along the Gulf coast have shifted to include both lower winter and higher summer sea levels, especially in the eastern Gulf, largely as a result of differing air surface temperatures and changes in mean sea level pressure (Wahl et al., 2013); these changes have doubled the risk of hurricane-induced flooding associated with SLR since the 1990s. The combination of SLR and land subsidence is forecast to result in various changes in the distribution and abundance of coastal wetlands and mangroves (*sensu* Craft et al., 2009), which could damage habitat functions for many important fish and shellfish populations. Geselbracht et al. (2015) forecast that by 2100 under a 1 m (3.3 ft) SLR scenario, the three habitats with the greatest loss in their study areas along the Florida Gulf coast will be coastal forest (-69,308 hectares (ha) [171,264 acres (ac)]); -18 percent), undeveloped dry land (-28,444 ha [70,287 ac]; -2 percent) and tidal flat (-25,556 ha [63,150 ac]; -47 percent). Conversely they forecast that the largest potential gains in cover will be for saltmarsh (+32,922 ha [81,352 ac]; +88 percent), transitional saltmarsh (+23,645 ha [58,428 ac]) and mangrove forest (+12,583 ha [31,093 ac]; +40 percent) habitats. Future SLR is expected to cause additional saltwater intrusion into coastal aquifers of the Gulf of Mexico, potentially making some unsuitable as potable water supplies (Karl et al., 2009). Saltwater intrusion and SLR are damaging coastal bottomland forests, primarily along the western Gulf of Mexico coast, and mangroves, through soil salinity poisoning, increased hydroperiods, and coastal erosion (Williams et al., 1999). Additionally, model predictions suggest there will be an increase in the intensity of hurricanes (IPCC, 2007, 2014), while under rising sea levels, coastal regions may potentially have fewer barrier islands, coastal wetlands, and mangrove forests to buffer resulting storm surges. New tools are available to examine more closely relative SLR that accounts for both eustatic SLR and subsidence-induce apparent SLR in the Gulf of Mexico (USACE, 2015c).

Marine biota in the Gulf of Mexico and elsewhere are influenced by changes in temperature, salinity, and ocean acidification (Hunter et al., 2015), as well as by their biological environment including predators, prey, species interactions, disease, and fishing pressure (Karl et al., 2009). Projected climate-driven changes in physical oceanographic conditions including circulation, temperature and acidity can affect the growth, survival, reproduction, and spatial distribution of marine fish species and of the prey, competitors, and predators that influence the dynamics of these species (*sensu* Craft et al., 2013). Predicting the consequences of these changes , on marine biota over small spatial extents associated with many management units (e.g., parks, sanctuaries) are difficult to down-scale, complicating their discrimination from natural variation (Rosenzweig et al., 2007; Breeze et al., 2012).

A 2004 USGS report projects the areas of coastal Louisiana that are expected to experience land loss and land gain by 2050 (Barras et al., 2004), a date that nearly coincides with the end of the 40- to 50-yr life of the Program. Projected areas of land gain and loss in the Central Planning Area are shown in **Figure C-5**, along with the locations of existing coastal OCS-related infrastructure. There is a clear association between infrastructure locations and land loss in some areas.

The authors of the 2004 USGS report did not consider the effects of climate change expected to occur between now and 2050 as a factor affecting coastal land loss in this region (Barras et al., 2004). The USGS developed the data shown in **Figure C-5** by projecting more than two decades of observations of land loss patterns and rates into the future. Processes related to climate change that could affect land loss patterns include projected acceleration in the rate of sea level rise, increase in the frequency and intensity of tropical weather systems in the Gulf of Mexico, and possible alterations in the hydrology and hydraulics of the Mississippi River system (Barras et al., 2004; IPCC, 2007). The USGS projections therefore should be considered a minimum land loss scenario for 2050 because the climate change effects that were not considered in the analysis, such as accelerated submergence and increased occurrence of large storms, should promote land loss rather than land accretion.

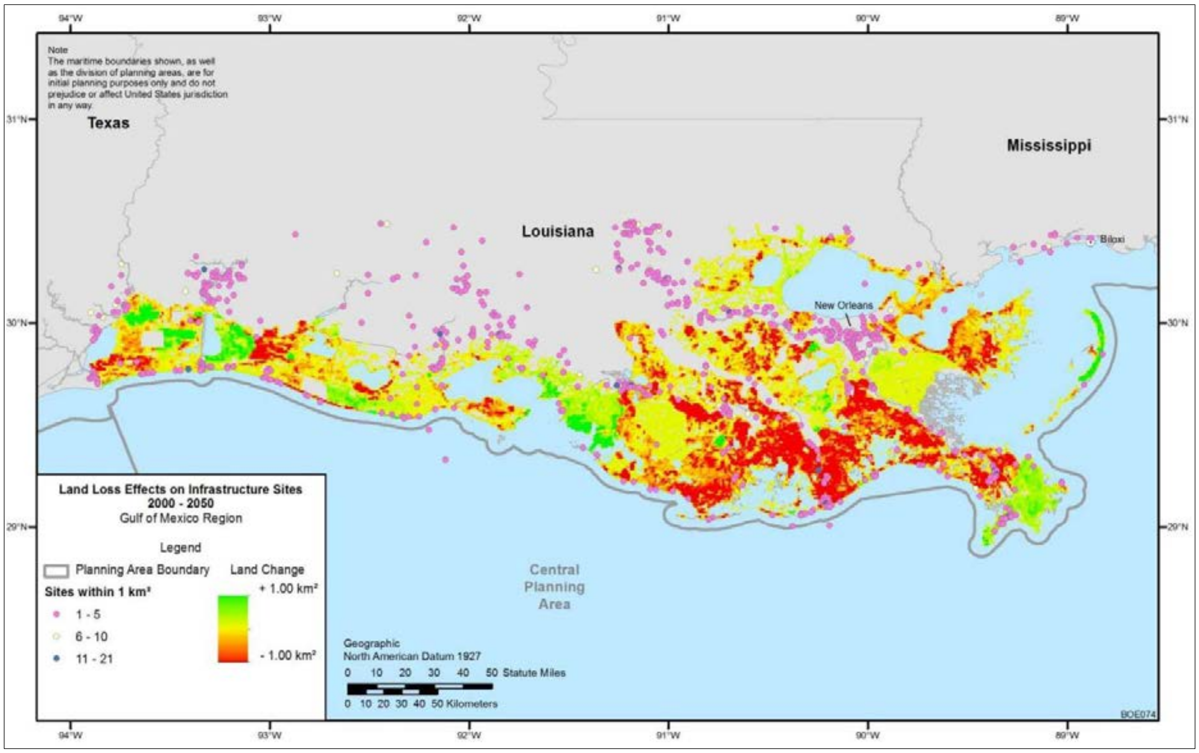


Figure C-5. Land Loss Effects on Infrastructure Sites From 2000 to 2050 in the Central Planning Area, Gulf of Mexico, (From: USDOI, BOEM [2012]).

Table C-2 lists relevant types of infrastructure facilities, in decreasing order of the percentage of specific facility type projected to be affected by land loss. A facility was considered potentially affected by land loss if its location occurred within a 1-km^2 (0.4-mi^2) cell that the original USGS data projected would experience land loss by 2050. The table shows that 38 percent of all terminal locations (or 145 individual terminals) are located in cells projected to experience land loss. Only 2 percent of electric generator locations, in contrast, are located in cells projected to experience land loss. The table also shows that all petrochemical plants, pipe coating yards, and gas storage and processing facilities, and nearly all electric generator facilities, are located in areas where land loss is not expected to occur. Therefore, extrapolations suggest land loss will not be an issue affecting the viability of these kinds of facilities.

Table C-2. Land Loss Effects on OCS-Related Facilities (From: USDOI, BOEM, 2012).

Facility Type	Percent of Facilities with Local Land Loss	Number of Sites Affected	Average Percent of Nearby Land Loss
Terminals	38	145	10
Ship repair yard	32	25	10
Service bases	32	18	7
Heliports	23	45	6
Ports	18	3	10
Waste handling sites	15	5	20
Platform fabrication	14	5	4
Refineries	13	2	7
Electric generators	2	4	2
Petreochemical plants	--	--	--
Pipe coating yards	--	--	--
Gas storage and processing	--	--	--

This analysis suggests that land conditions in coastal Louisiana could become less suitable for certain types of infrastructure uses during the life of the Program. Based on this analysis, terminals, ship repair yards, and service bases have the highest percentages of facility sites located in areas expected to experience land loss. These facilities also are located in areas expected to experience a relatively large amount of land loss, averaging nearly 10 percent of the nearby land, and therefore likely would be the most affected by changes to the landscape expected to occur by 2050. As mentioned previously, the effects of climate change during the Program likely will act to increase the projected amount of lost land (**Table C-2**).

The effects of land loss and submergence on OCS-related infrastructure in coastal Louisiana are being addressed by the LA1 Coalition, a non-profit organization working to improve transportation along the energy corridor through coastal Louisiana to the Gulf of Mexico. They have evaluated highway closures that could occur along the LA 1 highway, a critical transportation link for OCS-related service and shore bases, as a result of coastal submergence by 2050. Their analysis suggests that by 2030, critical sections of the highway could be closed up to 6 percent of the time, and that by 2050 closures could occur 55 percent of the time (LA1 Coalition, 2011). Such closures could have large effects on the OCS industry because of the high volume of OCS-related support and service products and materials transported across the highway.

1.1.3. Mid- and South Atlantic Region (MSAR)

Many of the impacts of climate change expected in the Gulf of Mexico also are expected along portions of the U.S. Atlantic Coast, including the mid-Atlantic and southeastern U.S. Atlantic coastal region (MSAR). As in the Gulf of Mexico, not only are coastal ecosystems likely to be impacted, but also the adjacent uplands and watersheds, forests, offshore areas, fisheries, and human use and business sectors (Ning et al., 2003; Titus et al., 2009).

As in the Gulf of Mexico, the MSAR has experienced increasing atmospheric temperatures, but these have been mitigated by the AMOC. The AMOC, a key component of the global climate system, is responsible for a large component of the meridional heat transport in the Atlantic basin (Johns et al., 2011). Boulton et al. (2014) report numerical modelling results indicating that a reduction in the AMOC would result in 1 to 3°C cooler North Atlantic surface air temperature, with enhanced local cooling of up to 8°C in regions where sea ice increased significantly (Vellinga and Wood, 2002; Jacob et al., 2005). Because a strong AMOC, particularly the southern tier (Gulf Stream) has a strong geostrophic effect on east coast sea level, a substantial weakening of the AMOC would promote SLRs of up to 80 cm along the coasts of North America with potential similar effects in Europe (Levermann et al., 2005; Vellinga and Wood, 2008).

Climate records indicate that the AMOC is bistable (either 'on' or 'off') (Cheng et al., 2013). What drives this apparent switch is unclear; it may be that increased freshwater input to surface waters or sea surface warming promote a density change that weakens the AMOC (Boulton et al., 2014). In some scenarios weakening of the AMOC results in a positive feedback that increases freshwater transport into the Atlantic. Numerical model projections suggest that the AMOC likely willweaken over the 21st century (Cheng et al., 2013), but the possibility of an abrupt collapse is very uncertain (Kriegler et al., 2009; Zickfeld et al., 2007). Nonetheless, recent increases in SST (Blunden and Arndt, 2014; IPCC, 2014) contribute to long-term concerns regarding the AMOC switch.

Coastal states within the Mid-Atlantic and South Atlantic Planning Areas provide an unstable land surface for development in many areas because of ongoing subsidence from exposure to tropical storms and hurricanes. Even without considering the effects of climate change, coastal landscapes in mid-Atlantic states and those of the U.S. southeastern coast are expected to undergo change during the life of the Program as a result of these processes. The "2009: Coastal Sensitivity to Sea-Level Rise: A Focus on the Mid-Atlantic Region" report indicated that the Atlantic Coast has been experiencing an average sea level rise of between 2 and 4 mm yr^{-1} (Titus et al., 2009). The World Resources Institute identified Virginia's Hampton Roads area as currently experiencing the highest rates of sealevel rise along the entire U.S. Atlantic Coast, second only to New Orleans (Tompkins DeConcini, 2014).

Sea level rise poses a large and continuing threat to regional activities, economy, and environments. Increasing temperatures and the associated increase in duration, intensity, and frequency of extreme heat events will impact the environment and public health, as well as industries such as forestry, agriculture, and energy-related businesses. The geographic distribution of these impacts and vulnerabilities will be uneven, since the region encompasses a wide range of environments, from the Appalachian Mountains to the coastal plains. The Atlantic Coast is a major producer of seafood and home to eleven significant ports that also could be vulnerable (Melillo et al., 2014).

Anthony et al. (2009) describe how climate change will promote changes in flushing regime, freshwater inputs, water chemistry, and inundation from SLR. These changes would negatively influence ecosystem services, especially by altering the structural impediments to landward migration of riparian communities. Changes in coastal ecosystems could be amplified in areas of the MSAR where there are low elevations and flat topography (Titus et al., 2009), especially along the coastline of North Carolina. Impacts in the Carolinas may be particularly amplified, given overlap of subtropical and temperate biogeographic provinces and species, prompting NOAA to select North Carolina as one of its five nationwide sentinel sites for SLR (USDOC, NOAA, National Ocean Service [NOS], 2015). New tools are available to examine more closely relative SLR in the MSAR that accounts for both eustatic and subsidence factors (USACE, 2015c).

In North Carolina the measured rate of sea level rise during the twentieth century is 3.0–3.3 mm y^{-1}. This incorporates a background rate of approximately 1 mm y^{-1}, plus an abrupt increase of 2.2 mm y^{-1} which began between A.D. 1879 and 1915 (Kemp et al., 2009). Kemp et al. (2009) reported that this abrupt increase occurred at other sites along the Atlantic coast synchronously, although the magnitude of the acceleration varied along the coast. At coastal sites farther north in the U.S. and Canada where isostatic rebound is limited, the acceleration was smaller, and these are already considered hotspots of SLR (Sallenger et al., 2012). Wahl et al. (2010) suggested that in the Gulf of Mexico, increased rates of SLR will increase the risk of hurricane-induced flooding substantially; this is also applicable to the MSAR especially as barrier island complexes shift (Stutz and Pilkey, 2011). Some low-lying metropolitan areas of the MSAR are already experiencing more frequent tidal flooding, even in the absence of storms or rainfall events (University of Miami, 2014).

Marine biota in the region (Hunter et al., 2015) are influenced by changes in temperature. In the coastal portion of the MSAR, the number of days expected to exceed 32°C between 2041 and 2070 rose 15 to 75 days y^{-1}, compared to the 1971 to 2000 period (Carter et al., 2015) with the potential for range extensions of subtropical species and range reductions for temperate species. Such shifts can change fishery economics along the coasts. Other factors related to climate that may influence marine biota in this region include shifts in salinity, and ocean acidification (Carter et al., 2015) that limit species distributions and vulnerability to disease and its spread (Hofmann et al., 2001). Karl et al. (2009) describe most ecological functions as being susceptible to climate change, including abundance, composition and distribution of predators and prey and attendant species interactions. Separating the influence of existing stressors including fishing pressure, which itself is expected to change with climate shifts that affect fishing stocks, is expected to prove extremely challenging (Karl et al., 2009, Craft et al., 2013).

Air quality is also expected to change. Plants and trees give off gases called volatile organic compounds (VOCs). Industrial sources also give off fine particles. VOCs and anthropogenic particles react with manmade emissions in the atmosphere to create ozone and aerosols which build haze. This aerosol-based haze reflects sunlight and contributes to added cloud formation, which may have local cooling effects – but also reduces incoming solar radiation reaching forests and crops, with unknown consequences. Climate change is expected to have a weaker global circulation (punctuated by extreme events) such that locally-produced pollutants may tend to accumulate, decreasing air quality. The potential impact of climate change on particle-based pollution is undergoing study and again, requires effective down-scaling of climate models to provide meaningful local forecasts. In the southeast (Melillo et al. 2014), higher temperatures and more frequent heat waves will increase heat stress, respiratory illnesses, and heat-related deaths. High temperatures also contribute to poor air quality, including the formation of ground-level ozone, which poses a risk to people with asthma and other respiratory illnesses. Ground-level ozone is projected to increase in the 19 largest urban areas of the southeast, likely increasing hospital admissions due to respiratory illnesses (USEPA, 2015d).

1.2. ACOUSTIC ENVIRONMENT

Various natural and anthropogenic activities contribute sound to the ocean, creating a complex acoustic environment. The acoustic environment comprises concomitant sounds, creating a regional background through which animals adapted to living in acoustically dominated habitats send and gather discrete signals. Changes in the acoustic environment can change an animal’s ability to function within its given habitat. Anthropogenic noise may be introduced into the environment for a specific purpose (e.g., navigational sonar and seismic exploration) or as an indirect by-product of activities such as shipping, construction, or other industrial activities. For purposes of understanding the sources and characteristics of the acoustic environment, ambient noise generally is divided into three bands: low frequency (10 to 500 Hertz [Hz]); medium frequency (500 Hz to 25 kilohertz [kHz]); and high frequency (>25 kHz) (Hildebrand, 2009). Variations in ambient noise level as a function of frequency can change by 10 to 20 decibels [dB] in seconds, minutes, or days, depending on variations in sound sources (Richardson et al., 1995). Variations in environmental conditions and sound propagation also can cause change in regional acoustic environments. The principle contributors to ambient noise in the low-frequency bands are shipping and the coupling of wind energy and water during storm events (Urich, 1983).

1.2.1. Acoustic Habitat

Acoustic habitat and soundscape ecology is a growing field that assesses a species’ ability to utilize available resources within its environment, including acoustic communication. Rather than competition with other species for acoustic habitat in which to communicate, species must now compete with increasing anthropogenic sound for resource partitioning. In the particular case of marine mammals, anthropogenic noise can be viewed as a form of habitat fragmentation, resulting in a loss of acoustic space that could otherwise be occupied by vocalizations or other acoustic cues important for cetacean ecology (Rice et al., 2014).

Primary acoustic habitat for a given species focuses within the vocal range of that species. Therefore, resource partitioning may be viewed on a frequency-band basis as well as an energy basis. A more comprehensive description of acoustic habitat requires an understanding of the distribution of sound pressure levels by their spectral probability density (Merchant et al., 2013, 2015), and knowledge of reception and exposure levels for coordinated species' densities. Additionally, large- and small-scale temporal fluctuations (e.g., daily, seasonal) in the acoustic environment and vocalization patterns contribute to an animal's acoustic resource use (Staaterman et al., 2014).

The sounds that marine mammals hear and generate vary in dominant frequency, bandwidth, energy, temporal pattern, and directionality. The same variables in ambient noise therefore determine a marine mammal's acoustic resource availability. Marine mammals using low frequencies (primarily mysticetes) likely have the most reduction in acoustic habitat availability due to the abundance of low-frequency anthropogenic noise within each Program Area. This concept is not unique to marine mammals. Ruppé et al. (2015) documented apparent resource partitioning in the acoustic communication behavior of a nocturnal marine fish community having 17 distinctive sounds that differed in peak frequency and pulsing characteristics. The sounds produced by soniferous species during the day did not overlap with those produced by nocturnal species and were far less diverse, suggesting that acoustic resource use is maximized when visual resource use is less important (Hastings and Sirovic, 2015).

In a study by Moore et al. (2012), Arctic acoustic habitats were characterized for two locations, one on the Chukchi Plateau and one in the Fram Strait. Overall, the Fram Strait site was a more complex acoustic habitat than the Chukchi Plateau site due to the year-round calls of bowhead whales (*Balaena mysticetus*) and odontocetes as well as year-round geophysical surveys using seismic sources in Fram Strait; these were only observed seasonally on the Chukchi Plateau. These differences between the two sites' acoustic environments mirrored the varying sea ice conditions, so that there were unique acoustic habitat windows for species that were ice-dependent and those that were not ice-dependent.

1.2.2. Major Contributing Sources of Noise

1.2.2.1. Natural Sources

The dominant physical mechanism of naturally occurring sound in the ocean is wind and wave activity near the ocean's surface. Sound levels associated with wind and waves generally are correlated, and occur in the low and medium-frequency band. Ambient noise levels tend to increase with increasing wind speed and wave height (Urick, 1984; Richardson et al., 1995). In the high-frequency band, "thermal noise" caused by the random motion of water molecules is the primary sound source (Hildebrand, 2009). Ambient noise sources, especially noise from wave and tidal action, can cause coastal environments to have particularly high ambient noise levels.

Precipitation on the ocean surface also generates sound in the water column. In general, noise from rain or hail is an important component of total noise at frequencies >500 Hz during periods of precipitation. Rain can increase natural ambient noise levels by up to 35 dB across a broad band of frequencies from several hundred Hz to >20 kHz (Richardson et al., 1995a; NRC, 2003). Heavy precipitation associated with large storms can generate noise at frequencies as low as 100 Hz and substantially affect ambient noise levels at a considerable distance from a storm's center (U.S. Department of the Navy, 2001).

Geological noise from earthquakes, volcanic activity, and hydrothermal venting can contribute to ambient noise at low frequencies, particularly in geologically active areas. Movement of sediment by currents across the seafloor can be a significant source of ambient noise at frequencies from 1 to >200 kHz (NRC, 2003).

Sea ice noise levels are highly variable and seasonal, but sea ice can be an important source of noise at high latitudes. Sea ice noise and some biological signals, namely from ice seals, are strongly correlated (Moore et al., 2012). The impact from ice cover varies according to the type of sea ice and the degree of sea ice cover, specifically whether ice is shore-fast pack ice, ice floes and moving pack ice, or located at the marginal ice zone (NRC, 2003).

Animals create biological noise and contribute heavily to ambient noise levels in certain areas of the ocean. Marine mammals are major contributors, but some crustaceans (e.g., snapping shrimp) and soniferous fish can be notable sound sources as well (Richardson et al., 1995; NRC, 2003).

1.2.2.2. Anthropogenic Sources

Shipping noise is the most important anthropogenic source of ambient ocean noise in the low-frequency band (NRC, 2003; Hildebrand, 2009), which has a broad maximum between 10 and 80 Hz, with a steep negative slope above 80 Hz. According to ambient noise spectra, levels from shipping are 60 to 90 decibels relative to 1 square micropascal per Hertz (dB re 1 $\mu Pa^2 Hz^{-1}$) (Hildebrand, 2009). A large portion of the noise from vessel traffic comes from vessel engines and propellers, and those sounds occupy the low-frequency bands in which most large whale calls and songs occur (Richardson et al., 1995). In open water, ship traffic can influence ambient background noise at distances of thousands of kilometers; however, the effects of ship traffic sounds in shallow coastal waters do not reach nearly as far, likely because a large portion of these sounds' intensities are absorbed by soft, non-reflective, unconsolidated muds and sands on the seafloor. Other anthropogenic sources of low-frequency noise include dredging, oil and gas operations, nearshore construction activities, recreational vessels, geophysical research operations, and military preparedness exercises (e.g., sonar signals).

Anthropogenic noise is an important environmental stressor, as chronic and frequent noise interferes with animals' abilities to detect important sounds (Francis and Barber, 2013). Clark et al. (2009) stated, "It is likely that acoustic masking by anthropogenic sounds is having an increasingly prevalent impact on animals' access to acoustic information that is essential for communication and other important activities such as navigation and prey/predator detection. Increasing anthropogenic sound may create loss of communication space," preventing marine life from using their primary means of experiencing their surroundings.

1.2.3. Acoustic Environments Within the Individual OCS Regions

Visual representations of an acoustic environment can be generated for regional oceans by plotting the ratios of energy present in selected frequency bandwidths. Changes in the acoustic environment are represented by a shift in dominant frequency, and by the increase or decrease in energy within a bandwidth. Modeled soundscapes and sound maps are generated using physical and biological oceanographic data combined with actual and predicted anthropogenic source data. These models represent the basis for assessment of the acoustic environment, and the analysis of potential impacts to species due to acoustic changes within that environment.

Shipping noise has been identified as the major contributor to the acoustic environments of the Atlantic and Arctic regions; shipping and geophysical surveying are the dominate contributors in the Gulf of Mexico Program Area. Sound maps for shipping have been modeled and mapped into NOAA CetSound layers and used to create the sound maps for the annual average ambient noise contributions from selected sources in each BOEM OCS Planning Area. Data sources used to develop the layers are described in **Table C-3**. Currently, data layers are only available as images; however, future release of underlying data is anticipated.

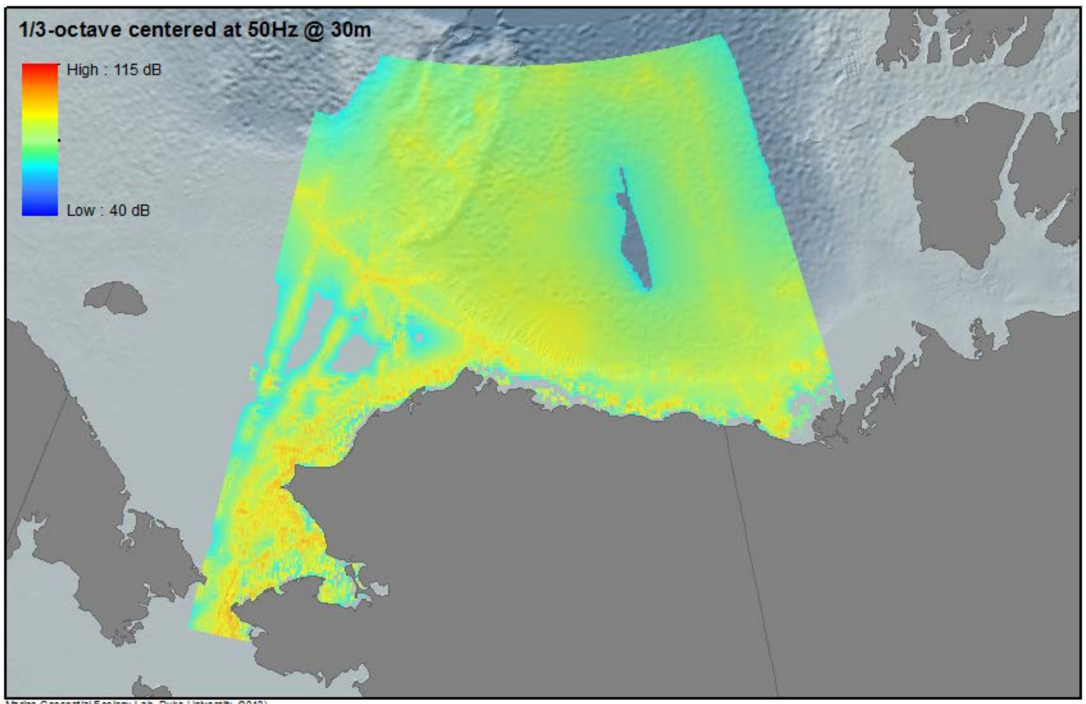
Table C-3. Annual Average Ambient Noise Data Sources from Sound Maps (From: USDOC, NOAA, 2015).

Database	Data Source(s)	Output	Data Available for Regions	1/3-Octave Band Selected for Analysis = Bandwidth Containing Dominant Energy
Global Shipping	Geospatial distribution of large commercial ships specifically cargo ships and tankers (>500 GT) derive from the World Meteorological Organization Voluntary Observing Ships Scheme (VOS). The specific data applied were collected from October 2004 to September 2005 (as reported in Halpern et al., 2008).	An approximately 10-km (6 mi) resolution grid representing global ship traffic, which is used as the basis for average annual global shipping distribution and density in the SFWG annual ambient noise modeling and consequently as the main component of background acoustic state in the noise event scenarios.	GOM, Arctic, Atlantic	50 Hz
Passenger Vessel	Based on Automatic Identification System (AIS) and VOS data from 2008 to 2010, compiled by the vessel tracking website www.sailwx.info.	An approximately 10-km (6 mi) resolution grid representing global passenger vessel traffic, which is used as the basis for the average annual global distribution and density of passenger vessels in SoundMap annual ambient noise modeling and consequently as a component of the background acoustic state in the noise event scenarios.	GOM, Arctic, Atlantic	50 Hz
Seismic Surveys	Based on detailed navigation files, the spatial and temporal distribution of 16 full-scale 2D and 3D seismic survey operations in the GOM during 2009 were provided by BOEM to the SFWG as a representative dataset of seismic survey operations for a nominal annual period.	Polygonal datasets for defining 3D surveys and linear datasets submitted for 2D surveys were assembled by BOEM. The resulting geospatial distribution of these 2D and 3D surveys were then used to model potential sound distribution, given certain assumptions, produced by air gun arrays over areas in the GOM during the period of each survey period.	GOM	100 and 200 Hz
Service Vessels	BOEM reports projecting service vessel traffic per rig from 2007 to 2012 and extrapolations from currently operating production rig and ports were used to derive an annual average density and distribution.	A 0.1° × 0.1° latitude-longitude grid (approximately 100 km^2 (38 mi^2) at the equator) representing the average annual distribution and density of service vessels.	GOM	50 Hz
Fishing Vessels	Time and date, and locations of fishing gear deployment and retrieval are recorded by NMFS Observers onboard the vessels for a period from late 2006 through mid-2011 with more than 220,000 entries from 327 vessels.	Tracks were overlaid within a 0.1° × 0.1° degree grid covering the latitudinal and longitudinal span of the dataset, with the total accumulated vessel time in each cell summed for SFWG noise modeling on approximately the same spatial scale.	None	None

GOM = Gulf of Mexico; SFWG = Sound-field Working Group.

1.2.3.1. Arctic Program Areas

Ambient sound levels in the Arctic are driven predominately by seasonal fluctuations in ice cover. Sea ice cover contributes to changes in naturally occurring physical and biological sounds in the region as well as regulating the introduction of anthropogenic sounds. This seasonality is unique to the Chukchi and Beaufort OCS regions. Long-term acoustic monitoring in Chukchi Sea between 2012 and 2013 (Delarue et al., 2014) showed received levels at a single bottom-mounted recorder (approximately 130 km [81 mi] north-northwest of Point Lay, Alaska), ranged from 88 to 133 dB re 1 μPa in winter and 81 to 147 dB re 1 μPa in summer. Two seismic surveys took place during the summer data collection period, which partly contributed to the overall higher noise levels during summer. The commercial ship traffic in the U.S. Arctic EEZ is represented by the sound maps of the 1/3-octave band centered at 50 Hz at 30 m (98 ft) water depth (**Figure C-6**).



Marine Geospatial Ecology Lab, Duke University (2012)

Figure C-6. Modelled Average Ambient Noise in the U.S. Arctic EEZ Attributed to Commercial Shipping, Showing the 1/3-Octave Band Centered at 50 Hz at 30 m (98 m) Water Depth (From: USDOC, NOAA, 2015).

Ice cracking events had a large (up to 20 dB) influence on the average sound pressure levels, but the brief high-intensity events had little influence on the median sound pressure levels for the recording period. Ice formation and movement likely reduces propagation as sound interacts with the rough sea surface. Biological input, particularly from marine mammals, are highly seasonal in species occurrence and species calling behaviors (Delarue et al., 2014). Low-frequency bowhead whale calls are common between April and June and again between September and December. Walrus knocks can be a dominant sound source between June and October while bearded seal (*Erignathus barbatus*) calls are abundant between November and June, with a present but slightly decreased vocal period between July and October. Beluga whale (*Delphinapterus leucas*) vocalizations are common between April and June.

1.2.3.2. Gulf of Mexico Program Area

There is defined acoustic zonation in the varying water depths of the Gulf of Mexico, and sound propagates differently depending on the amount of mixing at each depth and the source energy within the deep sound channel. Long-term ambient noise measurements were recorded and processed from seven environmental acoustic recording system (EARS) buoys in the Gulf of Mexico (Snyder, 2007). The buoys were deployed in the Eastern Planning Area between 2004 and 2005 at approximately 3,200 m (10,500 ft) water depth. The data showed that noise from wind and shipping were two of the principle noise sources under 1,000 Hz (Snyder, 2007). Other studies (Shooter, 1982) have shown that shipping and seismic exploration are the dominant drivers of ambient noise levels in the Gulf of Mexico. All ship traffic, including commercial, passenger, and service vessels associated with offshore energy facilities in the Gulf of Mexico, is represented by the sound maps of the 1/3-octave centered at 50 Hz at 30 m (98 ft) water depth (**Figures C-7** through **C-9**).

Seismic sources used during geophysical surveys are a major contributor of noise to the Gulf of Mexico. Sound maps depict the 1/3-octave centered at 100 and 200 Hz (**Figures C-10** and **C-11**) at 30 m (98 ft) water depth. Additionally, the 1/3-octave centered at 50 Hz is depicted in a sound map (**Figure C-12**) at 30 m water depth. Assumptions for the model are based on the geospatial distribution of 16 seismic surveys in the Gulf of Mexico during a typical year-long operating period. Nominal operational parameters for standard airgun arrays were used to represent all sources.

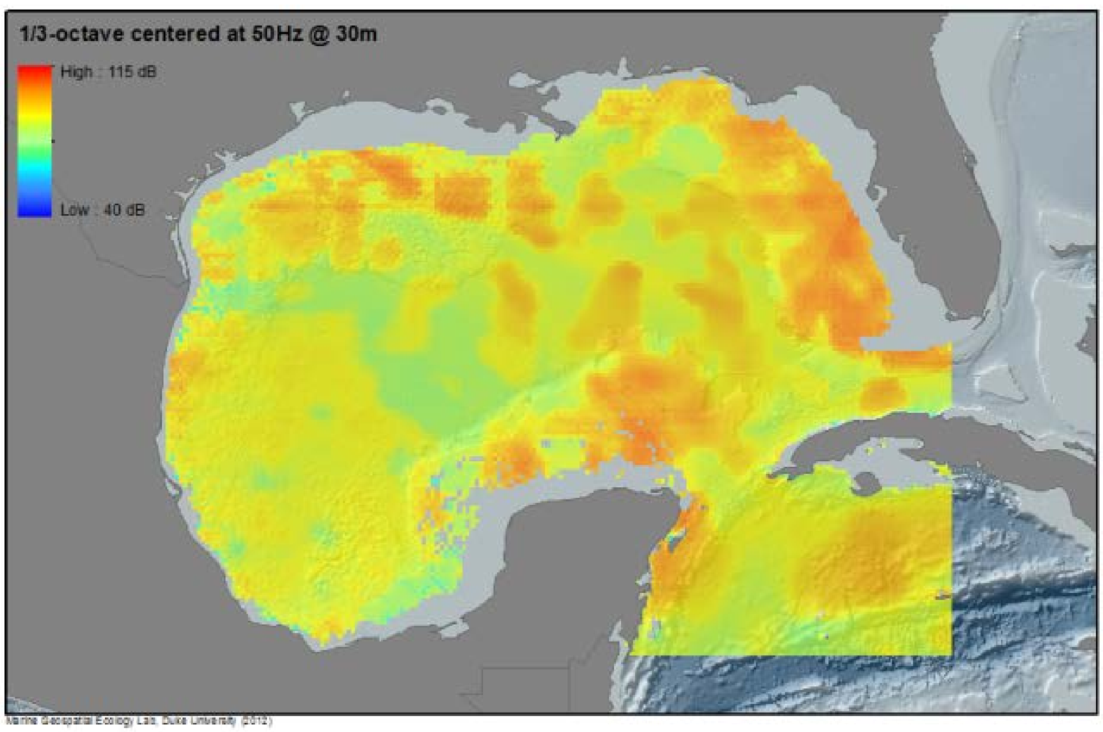


Figure C-7. Modelled Average Ambient Noise in the Gulf of Mexico Attributed to Commercial Shipping, Showing the 1/3-Octave Band Centered at 50 Hz at 30 m (98 ft) Water Depth (From: USDOC, NOAA, 2015).

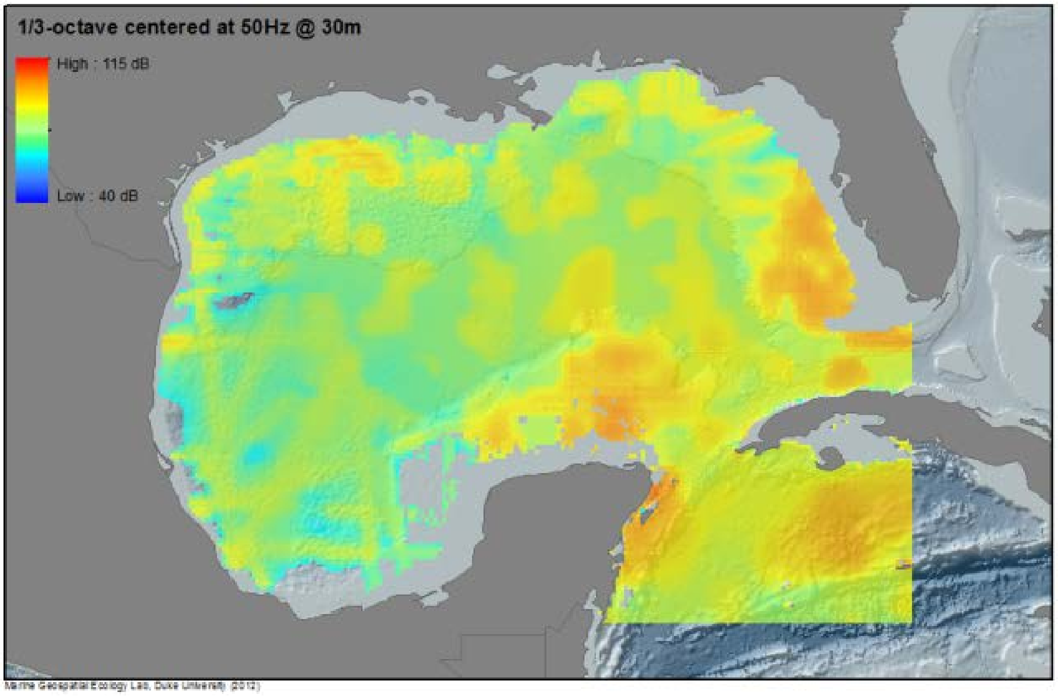


Figure C-8. Modelled Average Ambient Noise in the Gulf of Mexico Attributed to Passenger Vessels, Showing the 1/3-Octave Band Centered at 50 Hz at 30 m (98 ft) Water Depth (From: USDOC, NOAA, 2015).

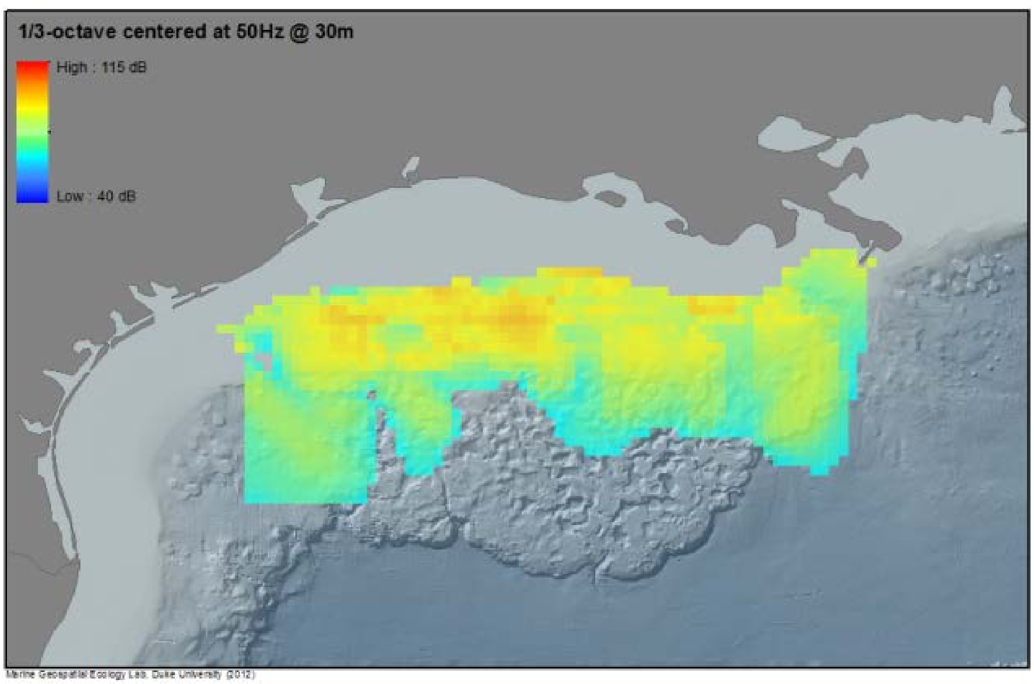


Figure C-9. Modelled Average Ambient Noise in the Gulf of Mexico Attributed to Energy Service Vessels, Showing 1/3-Octave Band Centered at 50 Hz at 30 m (98 ft) Water Depth (From: USDOC, NOAA, 2015).

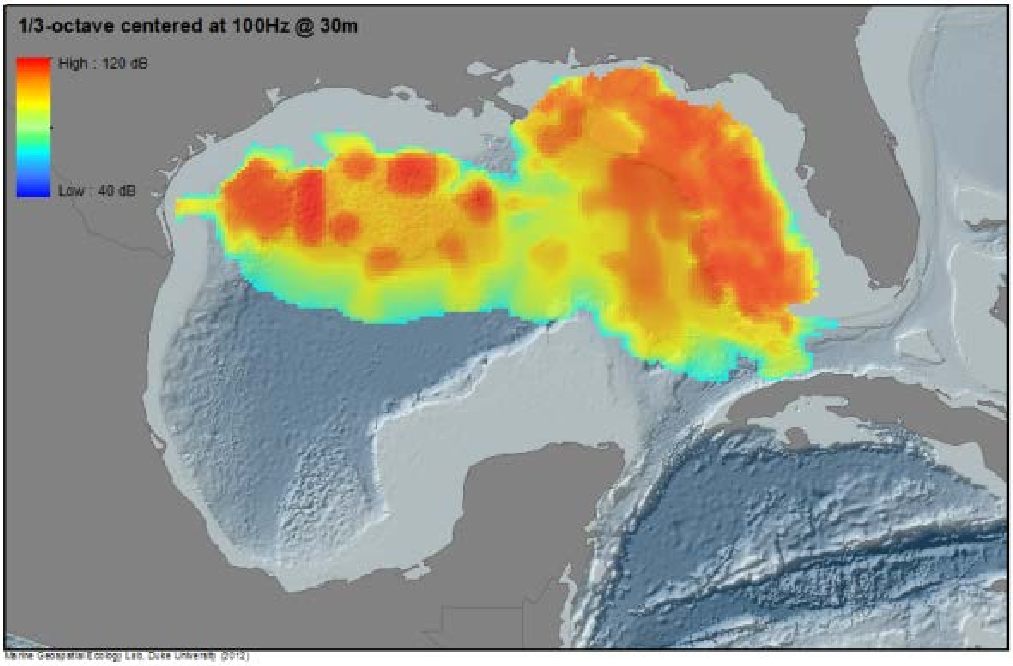


Figure C-10. Modelled Average Ambient Noise in the Gulf of Mexico Attributed to Only Seismic Surveys, Showing the 1/3-Octave Band Centered at 100 Hz at 30 m (98 ft) Water Depth (From: USDOC, NOAA, 2015).

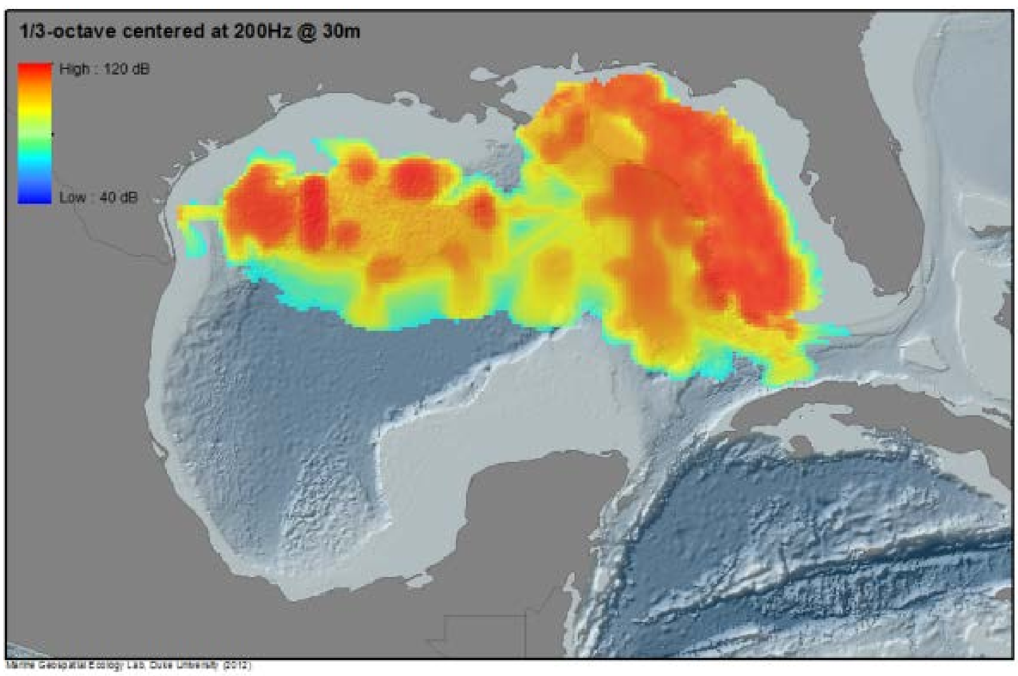


Figure C-11. Modelled Average Ambient Noise in the Gulf of Mexico Attributed Only to Seismic Surveys, Showing the 1/3-Octave Band Centered at 200 Hz at 30 m (98 ft) Water Depth (From: USDOC, NOAA, 2015).

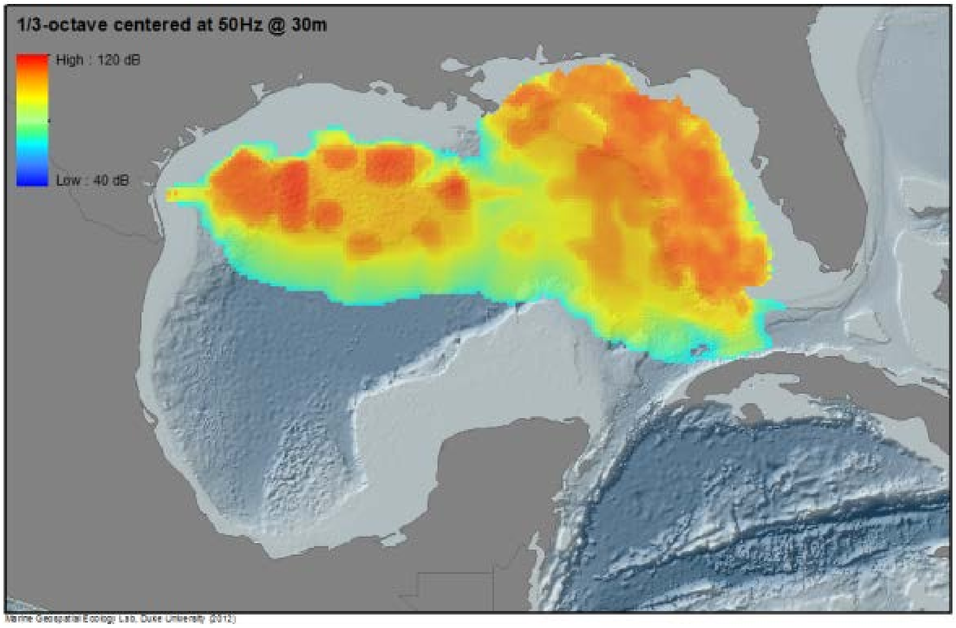


Figure C-12. Modelled Average Ambient Noise in the Gulf of Mexico Attributed Only to Seismic Surveys, Showing the 1/3-Octave Band Centered at 50 Hz at 30 m (98 ft) Water Depth (From: USDOC, NOAA, 2015).

1.2.3.3. Atlantic Program Areas

All ship traffic, including commercial traffic and passenger vessels in the Mid-Atlantic and South Atlantic Planning Areas, is represented by the summed output of commercial and passenger vessel sound maps of the 1/3-octave centered at 50 Hz at 30 m (98 ft) water depth (**Figures C-13** and **C-14**).

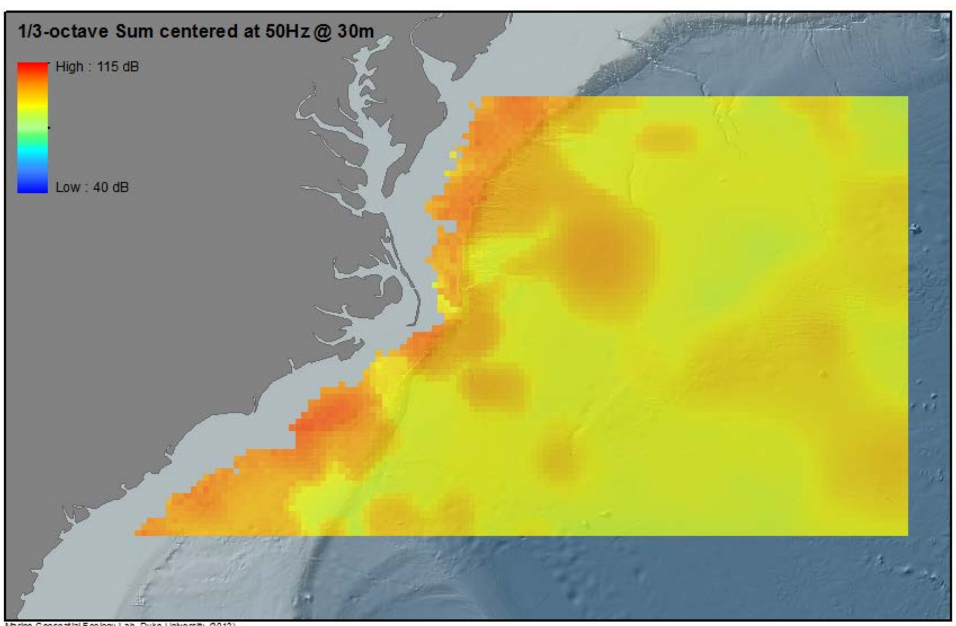


Figure C-13. Modelled Average Ambient Noise in the Mid-Atlantic Planning Area Attributed to Shipping, Showing the 1/3-Octave Band Centered at 50 Hz at 30 m (98 ft) Water Depth (From: USDOC, NOAA, 2015).

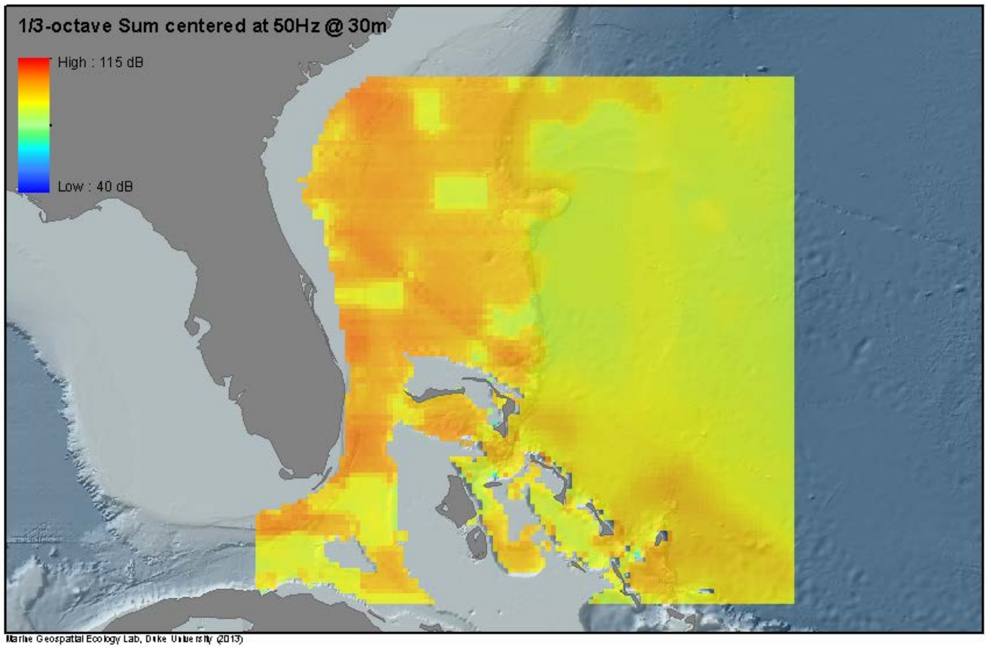


Figure C-14. Modelled Average Ambient Noise in the South Atlantic Planning Area Attributed to Shipping, Showing the 1/3-Octave Band Centered at 50 Hz at 30 m (98 ft) Water Depth (From: USDOC, NOAA, 2015).

2.0. AIR QUALITY

2.1. AMBIENT AIR QUALITY REGULATIONS, CLASS 1 AREAS, AND ATMOSPHERIC STABILITY

2.1.1. Ambient Air Quality Regulations

The Clean Air Act (CAA), as amended, requires the USEPA to set National Ambient Air Quality Standards (NAAQS) for six "criteria" pollutants considered harmful to public health and the environment: sulfur dioxide (SO_2), nitrogen dioxide (NO_2), carbon monoxide (CO), ozone (O_3), particulate matter (PM_{10} and $PM_{2.5}$) and lead (Pb) (USEPA, 2015a; 40 CFR 50). Collectively, the concentrations of criteria pollutants are indicative of ambient air quality. There are two types of NAAQS: (1) primary standards to protect public health, including sensitive populations (e.g., asthmatics, children, and the elderly), and (2) secondary standards to protect public welfare and "quality of life," therefore including protection against degraded visibility and damage to animals, crops, vegetation, and buildings. **Table C-4** presents the current primary and secondary NAAQS for the six criteria pollutants.

Table C-4. National Ambient Air Quality Standards.

Pollutant	Primary/ Secondary	Averaging Time	Level	Form
Carbon Monoxide	Primary	8-hour	9 ppm	Not to be exceeded more than once per year
		1-hour	35 ppm	
Lead	Primary and Secondary	Rolling 3-month average	0.15 $\mu g/m^3$	Not to be exceeded

Table C-4. National Ambient Air Quality Standards (Continued).

Pollutant		Primary/ Secondary	Averaging Time	Level	Form
Nitrogen Dioxide		Primary	1-hour	100 ppb	98th percentile of 1-hour daily maximum concentrations, averaged over 3 years
		Primary and Secondary	Annual	53 ppb	Annual mean
Ozone		Primary and Secondary	8-hour	0.070 ppm	Annual fourth-highest daily maximum 8-hour concentration, averaged over 3 years
Particle Pollution	$PM_{2.5}$	Primary	Annual	12 µg/m^3	Annual mean, averaged over 3 years
		Secondary	Annual	15 µg/m^3	Annual mean, averaged over 3 years
		Primary and Secondary	24-hour	35 µg/m^3	98th percentile, averaged over 3 years
	PM_{10}	Primary and Secondary	24-hour	150 µg/m^3	Not to be exceeded more than once per year on average over 3 years
Sulfur Dioxide		Primary	1-hour	75 ppb	99th percentile of 1-hour daily maximum concentrations, averaged over 3 years
		Secondary	3-hour	0.5 ppm	Not to be exceeded more than once per year

µg = microgram; PM = particulate matter; ppb = parts per billion; ppm = parts per million.

A state may adopt a more stringent set of State Ambient Air Quality Standards (SAAQS). If a state has no standard corresponding to one of the NAAQS or if the SAAQS are not as stringent as the NAAQS, then the NAAQS apply.

The USEPA has established classifications based on regionally monitored ambient air quality, in accordance with the Clean Air Act, as amended. If the air quality in an area meets or exceeds the NAAQS, the USEPA designates it as an "attainment area". When pollutant levels in an area repeatedly violate a particular standard, the area is classified as a "nonattainment area" for that pollutant. For nonattainment areas, federal regulations mandate that a deadline be set for the area to again attain the standard, depending on the severity of the regional air quality problem. Only areas within state boundaries are classified as attainment, nonattainment, or unclassifiable; therefore, there is no attainment status for regions outside the boundaries of state waters.

The CAA requires each state to create a State Implementation Plan (SIP) to demonstrate how it will attain and maintain the NAAQS. SIPs include the regulations, programs, and schedules that a state will impose on pollutant sources. SIPs must be regularly updated and must demonstrate to the USEPA that the NAAQS will be attained and maintained. Nonattainment areas, where air quality has improved to meet the NAAQS, are redesignated as maintenance areas and are then subject to an air quality maintenance plan.

Prevention of Significant Deterioration (PSD) regulations (see 40 CFR 52.21) are designed to limit the increase of some pollutants in clean areas. The regulations apply to major new pollutant sources or require modifications of existing major sources within an attainment or unclassified area. While the NAAQS (and SAAQS) place upper limits on air pollution, PSD increments place limits on the total increase in ambient pollutant levels above established baselines for NO_2, PM_{10}, $PM_{2.5}$, and SO_2, thus preventing "polluting up to the standard" (**Table C-5**).

Table C-5. Prevention of Significant Deterioration Increments (µg/m[3]).

Pollutant		Averaging Period	Class I	Class II	Class III
Carbon Monoxide		8-hour	-	-	-
		1-hour	-	-	-
Lead		Rolling 3-month	-	-	-
Nitrogen Dioxide		Annual	2.5	25	50
		1-hour	-	-	-
Ozone		8-hour	-	-	-
Particle Pollution	PM_{10}	Annual	4	17	34
		24-hour	8	30	60
	$PM_{2.5}$	Annual	1	4	8
		24-hour	2	9	18
Sulfur Dioxide		Annual	2	20	40
		24-hour	5	91	182
		3-hour	25	512	700
		1-hour	-	-	-

2.1.2. Class I Areas

All state air quality jurisdictions are divided into three protection classes. Class I Areas are federally owned properties with highly prized air quality-related values. No diminution of air quality, including visibility, is tolerated in Class I Areas, so that allowable increases in criteria pollutant concentrations are smallest, and air quality and air quality-related values such as visibility and acid deposition are given special protection. Class I Areas are under the stewardship of four federal agencies: USDOI's Bureau of Land Management (BLM), National Park Service (NPS), USFWS, and the U.S. Department of Agriculture's (USDA's) Forest Service (USFS). The USEPA has published a list of 156 federal Class I Areas as mandated in Subpart D of 40 CFR 81.400.

While incremental increases in PSD Class I Areas are strictly limited, increases allowed in Class II Areas are not as strict. In addition, states can choose a less stringent set of Class III increments, but none have done so. Major new and modified stationary pollutant sources must meet the requirements for the area where they are located as well as for any additional areas they impact. Thus, a source in a Class II Area near a Class I Area would need to meet the more stringent Class I increment in the Class I Area and the Class II increment elsewhere as well as satisfy any other applicable requirements.

The USEPA recommends that the permitting authority notify Federal Land Managers (FLMs) when a proposed PSD source would be located within 100 km (62 mi) of a federal Class I Area. If the source emissions are considered large, the USEPA recommends that sources beyond 100 km (62 mi) of a federal Class I Area be brought to attention of the appropriate FLM(s).

2.1.3. Program Areas

A description of air quality in individual program areas can be found in Section 4.3.1 of the Programmatic EIS.

3.0. WATER QUALITY

The term water quality describes the condition or environmental health of a water body or resource, reflecting its particular biological, chemical, and physical characteristics and the ability of the waterbody to maintain the ecosystems it supports and influences. It is an important measure for both ecological and human health.

In the case of coastal and marine environments, water quality is influenced by rivers that drain into the area, the basin configuration, the quantity and composition of wet and dry atmospheric deposition, and the influx of constituents from sediments. Besides natural inputs, human activity can contribute to water quality through discharges, runoff, dumping, air emissions, burning, and spills. Mixing or circulation of water either can improve water quality through flushing, or be the source of factors contributing to its decline. Furthermore, water quality and sediment quality may be closely linked. Contaminants, which are associated with suspended load, ultimately may reside in the sediments rather than in the water column. In coastal waters, water quality is controlled primarily by anthropogenic inputs associated with runoff, point source discharges from land, and atmospheric deposition. As distance from shore increases, oceanic circulation patterns disperse and dilute anthropogenic contaminants in an increasingly important way, thus determining water quality.

Water quality is evaluated by measuring factors that are considered important to an ecosystem's health. The primary factors influencing coastal and marine water quality are temperature, salinity, dissolved oxygen, chlorophyll content, nutrients, pH, oxidation reduction potential (Eh), pathogens, transparency (via measurements of water clarity, turbidity, or suspended matter), and concentrations of contaminants (e.g., heavy metals and hydrocarbons). Concentrations of trace constituents such as metals and organic compounds also can affect water quality.

The USEPA regulates all waste streams generated from offshore oil and gas activities. Section 403 of the Clean Water Act requires that National Pollutant Discharge Elimination System (NPDES) permits be issued for discharges to the territorial seas (baseline to 3 nautical miles [nmi] [5.6 km]), the contiguous zone, and the ocean, in compliance with USEPA's regulations for preventing unreasonable degradation of the receiving waters. Water Quality Standards assess the waterbody's designated uses, and define water quality criteria to protect those uses and to determine if those criteria are being attained, and antidegradation policies to help protect high quality waterbodies. Discharges from offshore activities near a state's water boundaries must comply with all applicable State Water Quality Standards. In general, waste streams that can be discharged overboard include water-based drilling fluids and drill cuttings, synthetic-based fluid-wetted drill cuttings, cement slurries, various treated waters and sanitary wastes, and uncontaminated freshwater and saltwater, provided they meet the criteria of the applicable NPDES permit.

3.1. ALASKA PROGRAM AREAS

This section provides a regional description of water quality in the Alaska Program Area, including the Beaufort Sea Planning Area, the Chukchi Sea Planning Area, and the northern portion of Cook Inlet Planning Area (Figure 2.1-1 in the Programmatic EIS).

3.1.1. Beaufort Sea and Chukchi Sea Planning Areas

The Beaufort Sea and Chukchi Sea Planning Areas are the northernmost shelf seas bordering Alaska. The Chukchi Sea is north of the Bering Strait and south of the Arctic Ocean. Marine waters flow through the Bering Strait with a mean northward flow over much of the shelf due to the Pacific-Arctic pressure gradient, which opposes prevailing northeasterly winds.

The Beaufort Sea extends approximately 500 km (311 mi) east from Point Barrow, Alaska to the Canadian EEZ (Figure 2.1-1 in the Programmatic EIS). The continental shelf is narrow, especially near and east of Point Barrow but widens near the delta of the Mackenzie River. Near the coast, water is <60 m (200 ft) deep, but depth rapidly increases northwards. Sea ice covers the shelf for much of the year, although in recent years most of the shelf has been ice-free from late July through early October. The Beaufort Gyre's clockwise motion dominates circulation.

3.1.2. Cook Inlet

Cook Inlet is a shallow, subarctic tidal estuary system located in south-central Alaska between the Kenai and Alaska Peninsulas (Figure 2.1-1 in the Programmatic EIS). Cook Inlet extends approximately 250 km (155 mi), from the Gulf of Alaska in the south to the city of Anchorage in the northeast, where it branches into shallower extensions (the Knik Arm, north of Anchorage and the Turnagain Arm, southeast of Anchorage). Cook Inlet is characterized by extreme tidal fluctuations of up to 12.2 m (40 ft), one of the highest diurnal tidal ranges in the world (USDOI, Minerals Management Service [MMS], 2000). The northern portion of the inlet experiences a tidal range of approximately 9 m (30 ft) (Saupe et al., 2005), which dominates the estuary's hydrodynamics and the associated estuarine ecosystem. Four major rivers, the Kenai, Knik, Matanuska, and Susitna Rivers drain into the northern and central portions of the Cook Inlet, constituting the largest riverine drainage to the Gulf of Alaska (USDOI, USGS, 2015b). These rivers input large quantities of freshwater, forcing density-driven currents producing a net flow of water along the west side of the estuary towards the mouth of Cook Inlet, and introducing significant amounts of glacial silt downstream into the coastal Gulf of Alaska (Saupe et al., 2005). The southern portion of Cook Inlet includes Kamishak Bay on the west side and Kachemak Bay on the east side. The waters of southern Cook Inlet are highly productive because nutrient-rich waters upwell through Kennedy and Stevenson Entrances at the mouth of the inlet.

Cook Inlet's watershed drainage area contains approximately two-thirds of the state's population and provides the potential for non-point source pollution runoff. Additional influences on water quality include onshore and offshore oil and gas exploration and production (Nuka Research and Planning Group, LLC, n.d.), municipal discharges including fecal pathogens (Norman et al., 2013), mining wastes, vessel traffic, fish-processing discharges, as well as numerous smaller industries (USDOI, BOEM, 2012). Point source pollution is rapidly diluted by Cook Inlet's energetic tidal currents; and estimates suggest 90 percent of the water in Cook Inlet is flushed every 10 months (USDOI, MMS, 2003). Several coastal impaired water bodies throughout the south central coastal area are impaired, so that total maximum daily load (TMDL) restrictions have been implemented (Alaska Department of Environmental Conservation [ADEC], 2013). Some remain on the Clean Water Act 303(d) List of Impaired Water Bodies given their TMDLs. Impaired areas are relatively small and mainly affected by urban runoff, timber harvest, petroleum products, or seafood processing (ADEC, 2013). These small impaired areas would not have an appreciable effect on marine water quality. The overall condition of south-central Alaska's coastal waters is rated good (USEPA, 2008).

3.2. GULF OF MEXICO PROGRAM AREA

This section provides a regional summary description of water quality in the Gulf of Mexico Program Area including the Western Planning Area and the Central Planning Area (Figure 2.1-2 in the Programmatic EIS). Most of the Eastern Planning Area is under a congressional moratorium until June 30, 2022. In the following, coastal and marine waters of the Gulf of Mexico are discussed separately. Coastal water includes all bays and estuaries from the Rio Grande River to the Florida Bay. Marine water comprises offshore state waters and federal OCS waters extending from outside the barrier islands to the EEZ. The inland extent is defined by the Coastal Zone Management Act. Marine waters are divided into three regions: the continental shelf west of the Mississippi River, the continental shelf east of the Mississippi River, and deep water (USDOI, BOEM, 2012b).

Deepwater Horizon Explosion, Oil Spill, and Response

The *Deepwater Horizon* explosion, oil spill, and response event released to the Gulf of Mexico an estimated 4.93 million barrels (bbl) of oil (Operational Science Advisory Team [OSAT], 2010) and between 200,000 and 500,000 tons of predominantly methane hydrocarbon gases (Joye et al., 2011a; Reddy et al., 2011). Additionally, estimates of dispersants applied to the spill at the surface and at depth range from 1.8 to 2.2 million gallons (OSAT, 2010; National Commission, 2011; Allan et al., 2012;

Joung and Shiller, 2013; Paul et al., 2013; Spier et al., 2013). The Federal Interagency Solutions Group's Oil Budget Calculator (2010) and the National Incident Command (NIC) (Lubchenco et al., 2010) assessed the fate of the oil and estimated that 25 percent was removed by burning, skimming, and direct recovery from the wellhead; 25 percent evaporated or dissolved into the water column; 24 percent dispersed into the water column; and 26 percent remained as oil on or near the water surface, as remaining or collected onshore oil, and as oil buried in sand and sediments (**Figure C-15**).

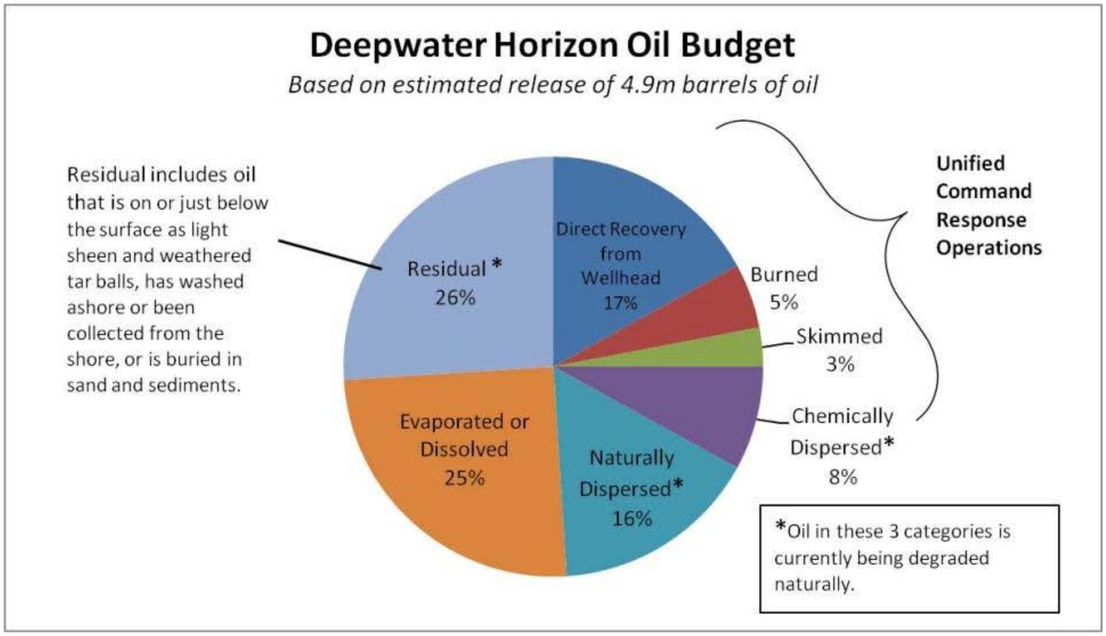


Figure C-15. Fate of Oil Released During the *Deepwater Horizon* Explosion, Oil Spill, and Response (From: Lubchenco et al., 2010).

After the spill, gases such as methane, ethane, propane, and butane were driving rapid respiration by bacteria (Valentine et al., 2010). However, the extent to which bacteria consumed these gases is under dispute (Joye et al., 2011b; Kessler et al., 2011b). More recent work identified a fallout plume of hydrocarbons from the wellsite over an area of 3,200 km^2 (1,988 mi) (Valentine et al., 2014). The analysis conducted by Valentine et al. (2014) suggests that oil was initially suspended in deep waters around the wellsite and then settled to the underlying sea floor. Similarly, Chanton et al. (2015) have estimated that 3.0 to 4.9 percent of the spilled oil was deposited in a 2.4×10^6 km^2 (593,050,500 mi^2) region surrounding the wellhead.

Dispersant ingredients were concentrated in hydrocarbon plumes at 1,000 to 1,200 m (3,281 to 3,937 ft) depth up to 300 km (186 mi) from the wellsite (Kujawinski et al., 2011). Dispersants underwent slow rates of biodegradation. Kujawinski et al. (2011) did not assess toxicity of dispersant found at depth, and acknowledged the need for further study to determine impact of the dispersants. The dispersant treatment to reduce oil droplet size may have increased the biodegradation rates of oil compounds in oil droplets in deepwater (Brakstad et al., 2015). However, DeLeo et al. (2015) have recently provided direct evidence for the toxicity of both oil and dispersant on deepwater corals. Toxicological assays revealed that corals showed more severe health declines in response to treatment with dispersant alone and with the oil–dispersant mixtures than to oil-only treatments indicating that the addition of dispersant during ensuing cleanup following the *Deepwater Horizon* event may have caused more damage to cold water corals than the initial release of oil into the deep sea.

After the *Deepwater Horizon* oil spill, the USEPA, NOAA, other agencies, and academic institutes measured coastal and deepwater water quality to determine any effect of the oil spill. The principal impacting factors to Gulf of Mexico water quality from the *Deepwater Horizon* event were (1) the release of oil, (2) the release of gas, and (3) the use of chemical dispersants.

OSAT (Unified Area Command) summarized water and sediment quality data in light of measured concentrations of oil- and dispersant-related chemicals collected from the start of the *Deepwater Horizon* event (April 2010) through October 2010 (OSAT, 2010). OSAT (2010) established a suite of sediment and water quality indicators to determine whether or not oil- and/or dispersant-related chemicals were in concentrations high enough to cause impacts to human health and aquatic life. Samples were collected in nearshore (shoreline to 3 nmi [5.6 km]), offshore (3 nmi [5.6 km] to 200 m [656 ft] depth), and deepwater (beyond 200 m [656 ft] depth) settings. Concentrations of oil- and dispersant-related chemicals in water and sediment samples did not exceed the benchmark for impacting human health; <1 percent of water samples and approximately 1 percent of sediment samples exceeded oil-related polycyclic aromatic hydrocarbon (PAH) concentrations resulting in impacts to aquatic life. However, none of the water sample exceedances were consistent with the *Deepwater Horizon* spill signature, and the sediment exceedances were limited to the area within 3 km (1.9 mi) of the wellhead.

Camilli et al. (2010) conducted a subsurface hydrocarbon survey to track the hydrocarbon plume associated with the spill. They found a continuous plume of dispersed oil at a depth of approximately 1,100 m (3,609 ft) that extended 35 km (22 mi) from the spill site. The plume consisted of monoaromatic petroleum hydrocarbons with concentrations >50 micrograms per liter ($\mu g\ L^{-1}$), and persisted for months with no substantial biodegradation. Additional water column concentration measurements were collected and revealed similarly high concentrations of hydrocarbons in the upper 100 m (328 ft) of the water column. PAH concentrations reached 189 milligrams per liter ($mg\ L^{-1}$) (or parts per billion [ppb]) at depths between 1,000 and 1,400 m (3,280 and 4,593 ft) near the wellsite and concentrations considered to be toxic to marine organisms in the same depth range were observed up to 13 km (8.1 mi) from the spill site (Diercks et al., 2010).

Bioavailable PAHs in coastal waters of Louisiana, Mississippi, Alabama, and Florida increased significantly following the spill (Allan et al., 2012). Boehm et al. (2011) reviewed total PAH (TPAH) concentrations in water samples collected through Natural Resource Damage Assessment efforts between April and October 2010 in offshore waters ≥ 4.8 km (3 mi) from shore. TPAH concentrations in 85 percent of samples were at or near background levels and concentrations attenuated rapidly with distance from the wellhead source due to dilution and biodegradation (Boehm et al., 2011). Edwards et al. (2011) reported higher rates of microbial respiration within the surface oil slick. Despite higher respiration rates, no increase in microbial abundances or biomass was observed within the slick, and this was attributed to a lack of available nutrients.

Spier et al. (2013) investigated the distribution and chemical composition of hydrocarbons within a 45 km (28 mi) radius of the wellhead. They discovered that hydrocarbons were dispersed over a wider area in subsurface waters than previously predicted or reported (e.g., Diercks et al., 2010; Valentine et al., 2010). The deepwater hydrocarbon plume predicted by models at 1,175 m (3,855 ft) was verified, and additional plumes were identified at 25, 265, and 865 m (82, 869, and 2,838 ft) depths. Furthermore, benzene concentrations were found at potentially toxic levels outside of areas previously reported to contain hydrocarbons and the application of subsurface dispersants was found to increase hydrocarbon concentration in subsurface waters (Spier et al., 2013).

Paul et al. (2013) collected water samples in the northeast Gulf of Mexico and along the West Florida Shelf to measure the general toxicity and mutagenicity of the upper water column. Twenty-one percent of samples were toxic to bacteria, 34 percent were toxic to phytoplankton, and 43 percent showed DNA-damaging activity. Additionally, the degree of toxicity in samples was correlated with total petroleum hydrocarbon (TPH) concentration, and mutagenicity persisted for at least 1.5 yr after the well was capped.

Sammarco et al. (2013) examined the geographic extent of petroleum hydrocarbon contamination in sediment, seawater, biota, and seafood during and after the spill, collecting samples from coastal waters between the Florida Keys and Galveston, Texas. TPH concentrations in seawater were relatively high and peaked off of Pensacola, Florida. Average concentrations of TPH and PAH in sediment samples were high throughout the study region.

Trace element distributions in the water column near the Macondo well were examined by Joung and Shiller (2013). In surface waters, barium, cobalt, copper, iron, manganese, and nickel were relatively well correlated with salinity, suggesting that mixing with river water was the primary influence on metal distributions. Conversely, at depths of 1,000 to 1,400 m (3,281 to 4,593 ft) within hydrocarbon plumes, elevated concentrations of cobalt and barium were observed. Cobalt concentrations were linked to the Deepwater Horizon oil signature, while barium concentrations were attributed to drilling muds used in attempts to stop the spill.

Michel et al. (2013) reported that shoreline assessment teams documented oiling on 1,773 km (1,102 mi) of surveyed shoreline (7,058 km [4,386 mi]) from Louisiana to Florida. The oiled shoreline comprised 50.8 percent beaches, 44.9 percent marshes and 4.3 percent other shoreline types. Shoreline cleanup activities were conducted and one year after the spill began, oil remained on 847 km (526 mi) of shoreline; two years later, oil remained on 687 km (427 mi) of shoreline. The degree of oiling decreased over time, so that the amount of heavily to moderately oiled shoreline declined by 87 percent in 1 year, and 96 percent in 2 years.

3.2.1. Coastal Water Quality

The U.S. portion of the Gulf of Mexico coast extends across five states, from the southern tip of Texas east, through Louisiana, Mississippi, Alabama, and through the Florida Keys. Including the shorelines of all barrier islands, wetlands, inland bays, and inland bodies of water, the combined coastlines of these states total more than 75,639 km (47,000 mi) (USDOC, NOAA, 2012a). The Gulf of Mexico coastal areas comprise more than 750 bays, estuaries, and sub-estuary systems that are associated with larger estuaries (USEPA, 2012).

More than 60 percent of U.S. drainage, including outlets from 33 major river systems and 207 estuaries, flows into the Gulf of Mexico (USEPA, 2014). Three major estuarine drainage areas (Texas, Mississippi, and West Florida) and three fluvial drainage areas (also Texas, Mississippi, and West Florida) have a large influence on water quality in the Gulf of Mexico (**Figure C-16**). Additional freshwater inputs into the Gulf of Mexico originate in Mexico, the Yucatán Peninsula, and Cuba.

Estuaries are influenced by both riverine fluxes of freshwater and sediment influx, and the tides. The primary factors that affect estuarine water quality include upstream withdrawals of water for agricultural, industrial, and domestic purposes; contamination by industrial discharges and sewage; agricultural runoff carrying fertilizer, pesticides, and herbicides; upstream land use; redirected water flows; and habitat alterations such as construction and dredge-and-fill operations (USDOI, BOEM, 2012). Because drainage from >60 percent of the U.S. enters the Gulf of Mexico, much of the country contributes to coastal water quality conditions there. The entire coast has microtidal ranges of <1.0 m (3.3 ft) and diurnal to mixed tides. Despite the small tidal amplitude, the large number of shallow water estuaries and the extent of the continental shelf can lead to significant tidal mixing that affects water quality, however, Gulf of Mexico coastal waters support vegetated habitats that stabilize shorelines from erosion, reduce nonpoint-source loads, and improve water clarity (USEPA, 2012).

Rivers emptying into the Gulf of Mexico bring freshwater and sediment into coastal waters, which affects their water quality (Gore, 1992). Rivers carry excess nutrients (e.g., nitrogen and phosphorus), contaminants from industrial wastewater discharge, urban runoff, and agriculture to downstream receiving waters.

Population growth in coastal areas can impact water quality. Since 1960 the population of the Gulf of Mexico's coastal U.S. counties has increased by >100 percent. From 2000 to 2004, the population expanded by 6.7 percent. Population growth results in additional land clearing, excavation, construction, and expansion of paved surface areas, and demands further drainage controls (U.S. Commission on Ocean Policy, 2004a, 2004b). These activities alter the quantity, quality, and timing of freshwater runoff. Storm water runoff, which may flow across impervious surfaces like parking lots, is more likely to be warmer than non-storm runoff, and to transport contaminants associated with urbanization, including suspended solids, heavy metals and pesticides, oil and grease, and nutrients.

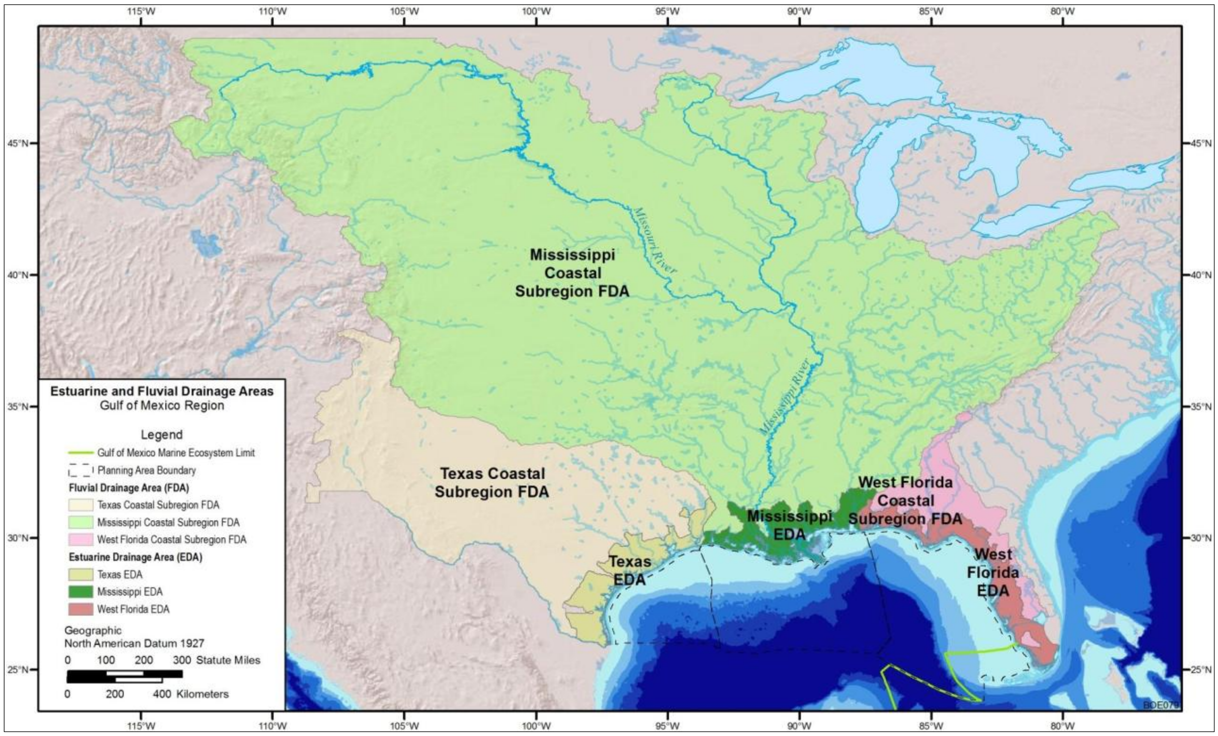


Figure C-16. Estuarine and Fluvial Drainage Areas of the Northern Gulf of Mexico (From: USDOI, BOEM, 2012a).

Coastal water quality is also affected by the loss of wetlands, discussed in detail in Section 4.3.2 of the Programmatic EIS. Wetlands filter runoff and improve water quality as suspended particulate material becomes trapped and removed from the water. Nutrients also may be incorporated into vegetation and wetland sediments and removed from the water that passes through wetlands.

In coastal waters of the Gulf of Mexico, water quality is influenced primarily by water temperature, total dissolved solids (salinity), suspended solids (turbidity), nutrients, anthropogenic inputs of land runoff, land point source discharges, and atmospheric deposition. With increasing distance from shore, oceanic circulation patterns play an increasingly large role in dispersing and diluting anthropogenic contaminants and determining water quality. Due primarily to the influence of the Gulf of Mexico's extensive estuary systems and input from the Mississippi River, areas of the Gulf Coast closer to shore show regional variation (USEPA, 2012).

The USEPA National Coastal Condition Report categorizes coastal waters of the U.S. based on an evaluation of five indices: water quality, sediment, benthic habitat, coastal habitat, and fish tissue contaminants. Rating scores are assigned based on a 5-point system, where a score of <2.0 is rated poor; 2.0 to <2.4 is rated poor to fair; 2.4 to <3.7 is rated fair; 3.7 to 4.0 is rated fair to good; and >4.0 is rated good. The Gulf of Mexico was divided into two biogeographical provinces (USEPA, 2012): the Louisiana Province; and the West Indian Province. The Louisiana Province extends from the Texas-Mexico border to Anclote Key, Florida and the West Indian Province extends from Tampa Bay, Florida, to the Florida Bay, Florida. The overall condition of coastal waters within the Gulf Coast is rated as fair with an index score of 2.4 (USEPA, 2012).

While the water quality index for the Gulf of Mexico's coastal waters is rated fair, the benthic index is rated fair to poor. Sediment quality and coastal habitat indices are rated poor. The fish tissue contaminants index is rated good (USEPA, 2012). Of the evaluation indices listed, sediment quality poses an impact risk to coastal water quality as contaminants in sediments may be resuspended into the water by anthropogenic activities, storms, or other natural events. Sediments in the Gulf of Mexico coastal region have been found to contain pesticides, metals, polychlorinated biphenyls (PCBs), and occasionally, PAHs (USEPA, 2012).

In addition to anthropogenic inputs and the Gulf of Mexico's estuarine and river systems, storms have had a significant impact on coastal water quality in the Gulf of Mexico Program Area. Both Hurricanes Katrina and Rita impacted water quality due to the resultant damage to pipelines, refineries, manufacturing and storage facilities, sewage treatment facilities, and other infrastructure. Katrina damaged 100 pipelines resulting in approximately 211 minor pollution reports, while Rita damaged 83 pipelines, resulting in 207 minor pollution reports (USDOI, MMS, 2006). In total, 113 platforms were destroyed and 52 incurred extensive damage (Moore, 2006). Additionally, 50 oil spills were reported in the nearshore environment ranging from 13,000 gallons to as much as 3.78 million gallons (Pine, 2006).

3.2.2. Marine Water Quality

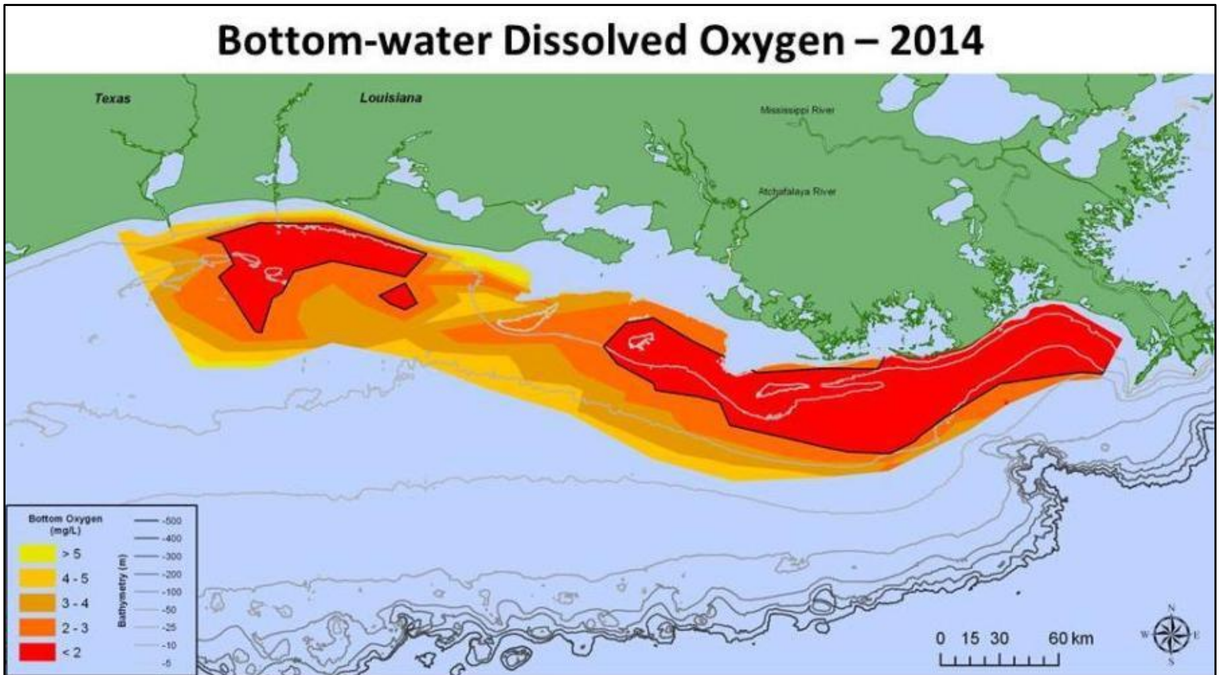
There are two primary influences on the composition of marine waters in the Gulf of Mexico: 1) basin configuration, which controls the influx of water from the Caribbean Sea, and the output of water through the Yucatán Channel; and 2) runoff, which controls the quantity of freshwater input into the Gulf of Mexico from estuarine and fluvial drainage areas. As noted previously, the three major estuarine drainage areas and three fluvial drainage areas drain 60 percent of the continental U.S, and so have a large influence on water quality in the Gulf of Mexico. The large amount of freshwater runoff mixes into Gulf of Mexico surface water, producing a different composition so that waters above the continental shelf have a different composition from those of the open Gulf of Mexico.

Marine waters are divided into three regions: the continental shelf west of the Mississippi River, the continental shelf east of the Mississippi River, and deepwater (USDOI, BOEM, 2012b).

3.2.2.1. Continental Shelf West of the Mississippi River

Water quality on the continental shelf west of the Mississippi River is predominantly influenced by the input of sediment, nutrients, and pollutants from the Mississippi and Atchafalaya Rivers (USDOI, BOEM, 2012b). A turbid surface layer is associated with freshwater plumes originating at these two rivers.

During summer months, shelf stratification results in a widespread hypoxic zone in bottom waters of the Louisiana-Texas shelf (Turner et al., 2005; **Figure C-17**). Hypoxia, where dissolved oxygen concentrations are <2 mg L^{-1}, is promoted by introduction of excessive nutrients and other oxygen-demanding contaminants, and oftentimes occurs when vertical stratification of the water column squelches mixing between oxygenated surface waters and bottom waters. The region subject to hypoxia on the continental shelf of the northern Gulf of Mexico (**Figure C-17**) is the second largest human-caused hypoxic zone in the world's coastal waters (Rabalais et al., 2002; Turner et al., 2005, 2012; Obenour et al., 2013). The hypoxic zone in the Gulf of Mexico occurs seasonally and is influenced by the timing of the Mississippi River and Atchafalaya River discharges, and formation of the zone is attributed to nutrient influxes and shelf stratification. Hypoxia persists until wind-driven circulation mixes the water column. Recent estimates of the areal extent of low oxygen through 1 August 2014 (USDOC, NOAA, 2015b) was 13,080 km^2 (5,052 mi^2) with an average size over 5 years (2010 to 2014) of 14,352 km^2 (5,543 mi^2). The size of the hypoxic zone is directly correlated with the flux of nitrogen from the Mississippi River (Turner et al., 2012).



Distribution of bottom-water dissolved oxygen July 27-August 1 (west of the Mississippi River delta), 2014. Black line indicates dissolved oxygen level of 2 mg/L.

Data source: Nancy N. Rabalais, LUMCON, and R. Eugene Turner, LSU
Funding sources: NOAA Center for Sponsored Coastal Ocean Research and U.S. EPA Gulf of Mexico Program

Figure C-17. Occurrence of Hypoxia in the Gulf of Mexico, Summer 2014.

Turner et al. (2003) found trace organic pollutants including PAHs, PCBs, and trace inorganic metals in shelf sediments offshore Louisiana that were attributed to river discharge. Additional input of hydrocarbons associated with natural seeps and oil and gas activity of the region were found further offshore (Turner et al., 2003). Additional inputs into the waters of the continental shelf are from discharges of drilling wastes, produced water, and other industrial wastewater streams from offshore oil and gas platforms in the area. While the USEPA regulates the discharge of these wastes through an NPDES permit the effects of these discharges are generally localized near individual points of discharge (Neff, 2005) when not located in shallow waters.

3.2.2.2. Continental Shelf East of the Mississippi River

Water quality on the continental shelf east of the Mississippi River also is influenced by river discharge and coastal runoff as well as by the Loop Current and its associated eddies. The Loop Current and its associated eddies intrude on the shelf at irregular intervals and mix the water column. Warm-core eddies bring clear, nutrient-depleted water onto the shelf and entrain and transport high turbidity shelf waters farther offshore into deeper waters, while cold-core eddies introduce nutrient-rich waters onto the shelf through upwelling. Waters in the area are generally turbid from the input of fine sediments discharged from the Mississippi River, but water clarity improves closer to Florida, away from Mississippi River outflow.

Multiple studies analyzed water, sediments, and biota for hydrocarbons in the Mississippi, Alabama, and Florida areas (Dames & Moore, Inc., 1979; Brooks and Giammona, 1990; Brooks, 1991). Results indicated only minor influence of anthropogenic and petrogenic hydrocarbons from river sources and natural seeps, and analysis of trace metals indicated no contamination sources.

3.2.2.3. Deepwater Water Quality

Water quality of the deepwater Gulf of Mexico may be closely tied to sediment quality, and the two can affect each other. For example, a contaminant may react with sedimentary mineral particles and be removed from the water column (i.e., adsorption). Thus, under appropriate conditions, sediments can serve as sinks for contaminants such as metals, nutrients, or organic compounds. However, if sediments are resuspended (e.g., due to dredging, a storm event, or in conjunction with seasonal mixing and circulation patterns), the resuspension can lead to a temporary redox flux, including a localized and temporal release of any formally sorbed metals, as well as nutrient recycling (USDOI, BOEM, 2012b).

Limited information is available with respect to the deepwater environment of the Gulf of Mexico. Few studies analyzing concentrations of trace metals and hydrocarbons in sediments have been conducted and water column measurements have been primarily limited to oxygen, salinity, temperature, and nutrients (Trefry, 1981; Gallaway, 1988; Continental Shelf Associates, Inc., 2006; Rowe and Kennicutt, 2009).

Deepwater water and sediment quality are most directly impacted by natural hydrocarbon seeps estimated to input from 1 to 1.4 million bbl yr^{-1} into the Gulf of Mexico (Kvenvolden and Cooper, 2003; NRC, 2003). Natural seeps are extensive along the continental slope of the Gulf of Mexico and are the largest source of petroleum hydrocarbons to the marine environment.

Pelagic tar is a common form of hydrocarbon contamination present in the Gulf of Mexico’s offshore environment (Van Vleet et al., 1983a, 1983b; Farrington, 1987). Higher tar concentrations are closely correlated with proximity to the Loop Current (Van Vleet, 1983b; Farrington, 1987). Van Vleet et al. (1983a) estimated that that approximately 7,112,328 kg (7,000 t) of pelagic tar are discharged annually from the Gulf of Mexico into the Atlantic and that approximately half of the oil may originate in the Caribbean, introduce to the Gulf of Mexico via the Loop Current, while the remainder appears to originate in the Gulf of Mexico. Van Vleet et al. (1984) characterized pelagic tar balls collected from the eastern Gulf of Mexico, finding that more than half of the samples could be attributed to tanker operations, while the rest had unknown sources.

3.3. ATLANTIC PROGRAM AREA

This section provides a regional description of water quality in the Atlantic Program Area including portions of the Mid-Atlantic and South Atlantic Planning Areas (Figure 2.1-3 in the Programmatic EIS). Coastal waters include all bays and estuaries from the Delaware Bay to approximately Cape Canaveral, Florida. Marine waters include both state offshore water, and federal OCS waters extending from outside barrier islands to the EEZ. The inland extent is defined by the Coastal Zone Management Act.

Balthis et al. (2009) assessed the water quality and sediment and benthic communities of the Mid-Atlantic Bight region, which encompasses the Mid-Atlantic Planning Area. Windom (2013) and Cooksey et al. (2010) provided a detailed description of the chemical oceanography, water quality, and sediment and benthic communities of the South Atlantic Planning Area.

3.3.1. Coastal Water Quality

Water quality in coastal waters of the Atlantic is controlled primarily by anthropogenic inputs associated with runoff, point source discharges on land, and atmospheric deposition. While most threats to marine water quality originate on land, ocean circulation plays an increasingly large role in dispersing and diluting anthropogenic contaminants as distance from shore increases. Due primarily to the influence of tidal plumes exiting estuaries, areas of the Atlantic closer to shore show major local variations in water quality (USDOI, MMS, 1992). Along the coastline, water quality is influenced by cities and other large nearby populations with associated non-point pollution sources: urban runoff containing oil, greases, and nutrients; domestic and sanitary wastes; and large expanses of agricultural land where fertilizers and biocides are applied.

3.3.2. Marine Water Quality

Offshore water quality in the Atlantic Program Areas is expected to be generally good to excellent, with minimal water column stratification. Together, observations of high water clarity, dissolved oxygen concentrations at or near saturation, low concentrations of suspended matter, and low concentrations of trace metal and hydrocarbon contaminants indicate good water (USEPA, 1998). Turbidity is typically low in Mid-Atlantic marine waters, generally <1 mg L^{-1} (Louis Berger Group, Inc., 1999). Suspended matter and turbidity vary locally between surface and bottom waters, seasonally as a function of rainfall and riverine discharge, and are located in different areas because of differing sources and grain sizes. They increase naturally during storm events. Turbidity may be temporarily affected by dredging activities; in offshore waters, elevated turbidity is primarily associated with disposal at approved offshore sites. Such disposal sites are located, designed, and operated under permit guidelines of the Clean Water Act and the Marine Protection, Research, and Sanctuaries Act to ensure any changes in turbidity are localized and short-term (USEPA, 2011).

Balthis et al. (2009) and Cooksey et al. (2010) conducted surveys of ecological conditions throughout coastal shelf waters of the Mid-Atlantic Bight (MAB) and South-Atlantic Bight (SAB) (Figure 2.1-3 in the Programmatic EIS). Results were compared to the estuarine conditions assessed by National Coastal Assessment (NCA) surveys that developed an ocean condition rating for applicable indices including water quality, sediment, benthic conditions, and fish tissue contaminants (USEPA, 2012). In both the MAB and SAB, there were no major indications of poor water quality or poor sediment quality. All sampling locations were rated good for sediment contaminants, showing no acute toxicity. The fish tissue contaminants index was rated fair. Concentrations of methylmercury and PCBs were observed. However, no tissue concentrations exceeded the upper endpoint for any contaminant. No major evidence of impaired benthic conditions were observed and the benthic index was good. Results suggest that coastal ocean waters and sediments of the MAB and SAB are in good condition.

4.0. COASTAL AND ESTUARINE HABITATS

4.1. ALASKA PROGRAM AREAS

4.1.1. Beaufort Sea and Chukchi Sea Planning Areas

4.1.1.1. Coastal and Estuarine Habitats

This section discusses the locations, extent, and physical attributes of coastal and estuarine habitats along shorelines of the Beaufort Sea and Chukchi Seas that could be affected by spills within the Beaufort Sea and Chukchi Sea Planning Areas (Figure 2.1-1 in the Programmatic EIS). The use of these habitats by birds, wildlife, fish, and other marine life is discussed in other sections of this Programmatic EIS.

Low-relief coastal and nearshore habitats along the shorelines of the Beaufort and Chukchi Seas include barrier islands and beaches, wetlands comprising low tundra, marsh, bottomland swamp, mangrove, and scrub/shrub communities, tidal flats, and seagrasses. These habitats occur within estuarine watersheds in and around bays, lagoons, and river mouths where marine waters and fresh waters intermix (Wilkinson et al., 2009). Coastal habitats of the Beaufort and Chukchi Seas are shown in **Figures C-18** and **C-19**.

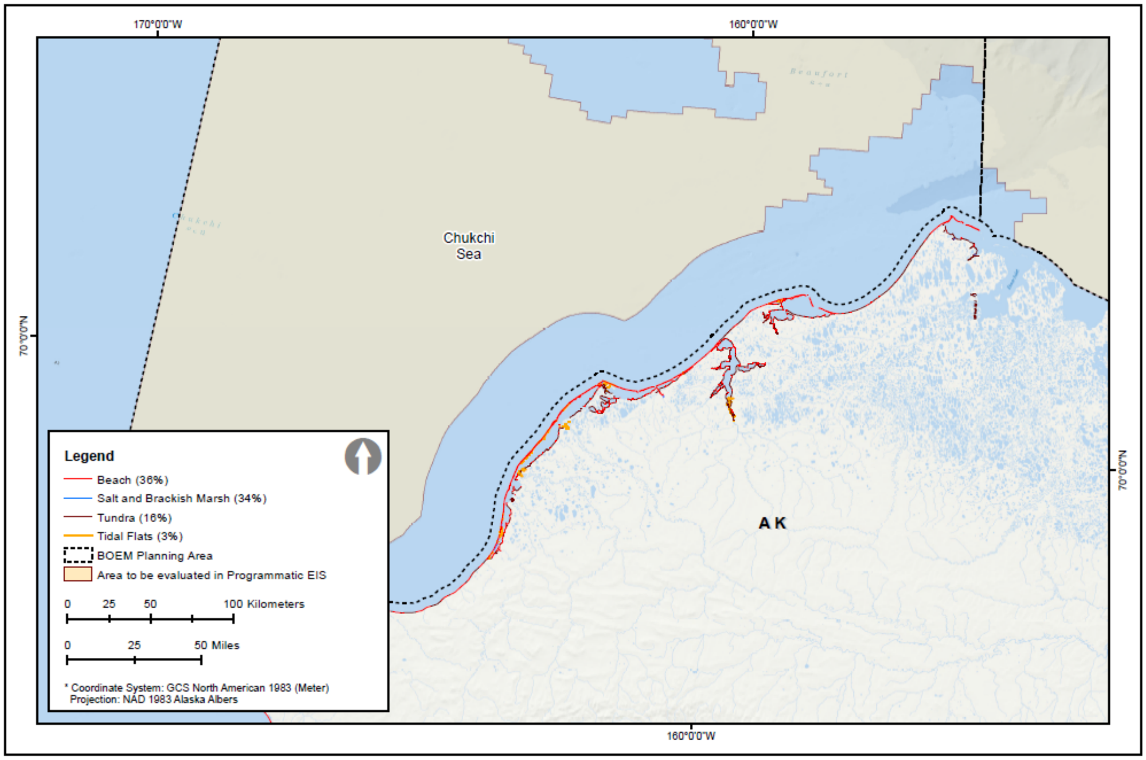


Figure C-18. Coastal and Estuarine Habitats of the Chukchi Sea Program Area (From: USDOC, NOAA, Office of Resource Restoration [ORR], 2015).

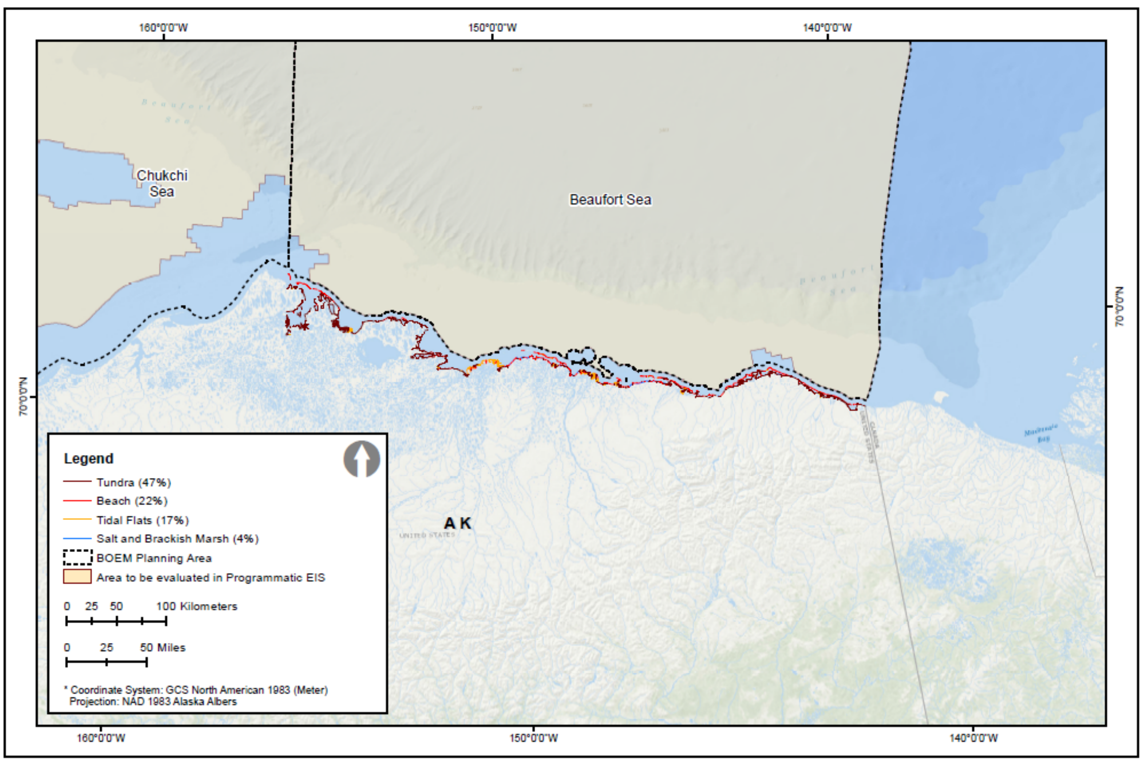


Figure C-19. Coastal and Estuarine Habitats of the Beaufort Sea Planning Area (From: USDOC, NOAA, ORR, 2015).

The Alaskan coast of the Beaufort Sea is approximately 660 km (410 mi) in length, extending from the Canadian border in the east, to the Chukchi Sea at Point Barrow in the west, and includes eroding bluffs, sandy beaches, lower tundra areas with some saltwater intrusions, sand dunes, sandy spits, and estuarine areas where streams enter the Beaufort Sea. Deltas of the Colville, Sagavanirktok, Kadleroshilik, and Shaviovik Rivers support a complex mosaic of wet Arctic salt marsh, dry coastal barrens, salt-killed tundra, typical moist and wet tundra, and dry, partially vegetated gravel bars. The Beaufort Sea coastline also includes bays and lagoons, as well as Stefansson Sound, which is enclosed by barrier islands.

The Alaskan coast of the Chukchi Sea is approximately 600 km (370 mi) in length, extending from Point Barrow to Point Hope, and consists of nearly continuous sea cliffs cut into permafrost (permanently frozen soil). The predominance of shore-fast ice along these shorelines precludes most vegetation and benthic fauna from establishing on the coastal barrens. While the cliffs are abutted by narrow beaches along most of the coastline, in some areas, barrier islands enclose shallow lagoons. Estuarine wetland systems occur in enclosed and protected bays and lagoons, including Omalik Lagoon, Kasegaluk Lagoon, Icy Cape, Peard Bay, Wainwright Inlet, and Kugrua Bay. These areas are characterized by low-energy sandy beaches and sand/silt tidal flats with brackish-water sedge marshes along their margins.

Arctic coastal habitats are greatly influenced by a short growing season and extremely cold winters. Onshore sediments are frozen during most of the year and are underlain by permafrost. The region is covered by a combination of landfast ice (which is attached to the shore and can extend from shore for 20 to 80 km [12 to 50 mi]), and pack ice from October to June (Wilkinson et al., 2009). The summer season is marked by inland thaws that expose extensive wetlands, rivers, and low-growing vegetation (USDOC, NOAA, 2013).

Coastal and estuarine habitats of the Beaufort Sea and Chukchi Sea Planning Areas are greatly affected by the dynamics of sea ice, which is more extensive and lasts longer in the Beaufort Sea than the Chukchi Sea (Hopcroft et al., 2008; Forbes, 2011). Sea ice highly disturbs the Arctic coastline because it frequently is pushed onshore, scouring and scraping the coastline (Forbes, 2011). Coastal regions with frozen unlithified sediments undergo particularly rapid summer erosion. The highest regional mean coastal erosion rate in the Arctic, 1.15 m yr^{-1} [3.8 ft yr^{-1}], occurs along the coast of the Beaufort Sea (Forbes, 2011).

Algae growing on the underside of sea ice can be the primary source of productivity, supporting higher trophic-level consumers such as Arctic cod, seals, and birds. In addition, sea ice provides shelter and resting habitat for marine mammals and birds (Bluhm and Gradinger, 2008). Ice movement causes continuous sediment scouring, resulting in chronic disturbance to the benthic communities, with few species inhabiting the seafloor in waters shallower than 2 m (6.6 ft) (Gradinger and Bluhm, 2005).

4.1.1.2. Barrier Islands

Barrier islands are common along coastlines of the Beaufort and Chukchi Seas, typically enclosing lagoons, as near Icy Cape and Point Franklin. Barrier islands are generally <250 m [820 ft] wide and have elevations <5 m (16 ft) (Hall et al., 1994; USDOC, NOAA, 2013). Although many barrier islands are low-lying, some of the barrier islands along the Chukchian coastline such as Cape Lisburne, front steep cliffs cut into bedrock up to 260 m (853 ft high) (USDOI, BOEM, 2012a).

The most continuous stretches of barrier islands occur at Point Hope at Marryat Inlet/Kukpuk River Delta and nearby Aiautak Lagoon and Kasegaluk Lagoon. These barrier island beaches are composed primarily of silty to sandy sand and gravel (Wilkinson et al., 2009).

4.1.1.3. Beaches

Beaches along the Beaufort and Chukchi Seas are typically associated with barrier islands (Wilkinson et al., 2009). In the Chukchi Sea, 36 percent of the shoreline is beach (**Figure C-18**). In the Beaufort Sea, 22 percent of the shoreline is beach (**Figure C-19**).

4.1.1.4. Tidal Flats

Some of the nation’s most extensive complexes of tidal flats occur along the coasts of the Beaufort Sea and Chukchi Sea; particularly at the deltas of the major rivers and along a few protected bays such as Kasegaluk Lagoon (Hall et al., 1994). These areas are composed of sand and silt exposed at low tides, and inundated by high tides and storm surges. Tidal flats are commonly associated with wetland systems, as discussed in Section 4.3.4 in the Programmatic EIS. Tidal flats represent three percent of the mapped coastline in the Chukchi Sea and 17 percent of the mapped coastline in the Beaufort Sea (**Figures C-18** and **C-19**).

4.1.1.5. Rocky Shores

In some areas, along the Chukchian coastline such as Cape Lisburne, there are steep cliffs cut into bedrock up to 260 m (853 ft high) (Hartwell 1973). Rocky shores provide substrate for encrusting organisms and marine algae, cover for small marine animals, and feeding areas for fish, birds, and other wildlife.

4.1.1.6. Tidal Rivers

Numerous large rivers discharge into the Beaufort and Chukchi Seas. The Colville, Kuparuk, Sagavanirktok, Canning, Kadleroshilik and Shaviovik Rivers discharge into the Beaufort Sea, while the Kukpuk, Kukpowruk, Utukok, and Kuk Rivers discharge into the Chukchi Sea (**Figures C-20a** and **C-20b**, respectively). The margins of many coastal rivers typically include gravel bars, sandbars, and sand dunes. Large, braided rivers, like the Sagavanirktok, include extensive predominantly unvegetated or sparsely vegetated areas (USDOI, BOEM, 2012a).

Stream flows generally are highest in late May or early June, with more than half of the annual discharge of a stream sometimes occurring over a period of several days to a few weeks (USDOI, BOEM, 2012a). Fluvial discharges introduce dissolved and suspended materials into estuarine and marine waters. Some components of the introduced materials serve as nutrients that enrich marine and coastal productivity while other components serve as pollutants that can degrade habitat quality. The fluvial discharges also carry suspended and bedload sediments that when deposited at the river mouths and redistributed through the coastal zone provide the substrate and foundation for many coastal habitats, including beaches and tidal flats (USDOI, BOEM, 2012a).

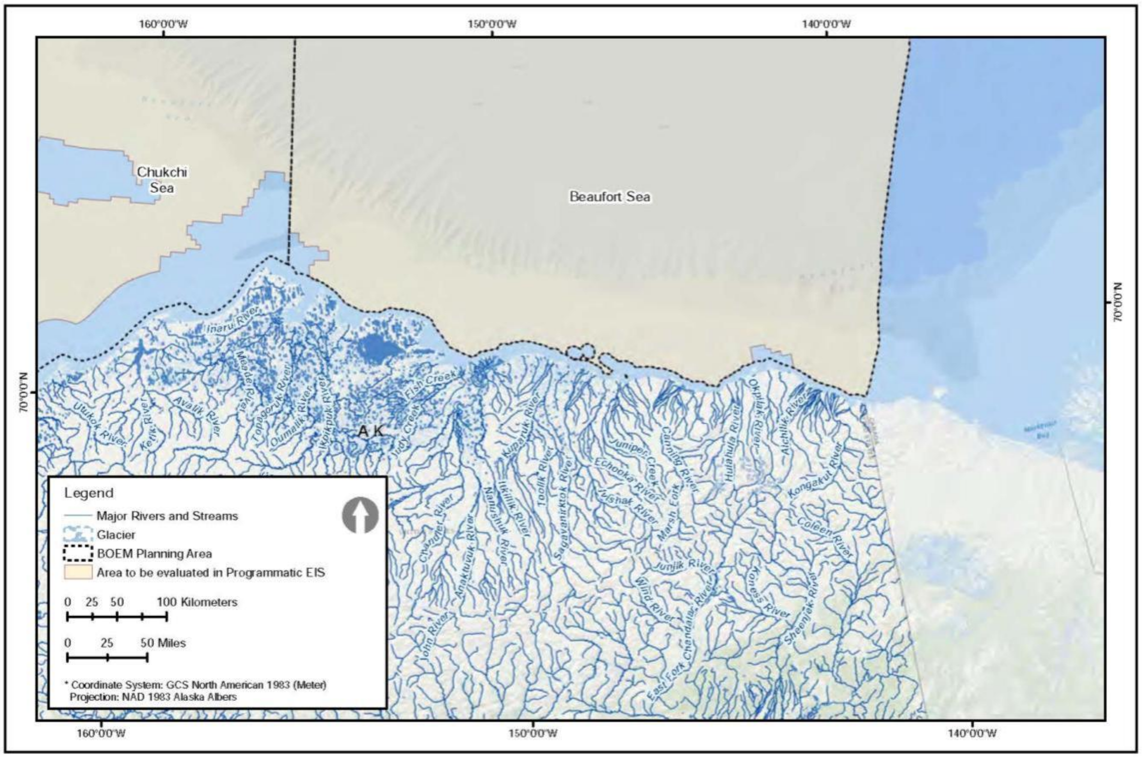


Figure C-20a. Major Rivers Entering the Beaufort Sea and Chukchi Sea Planning Areas (1 of 2).

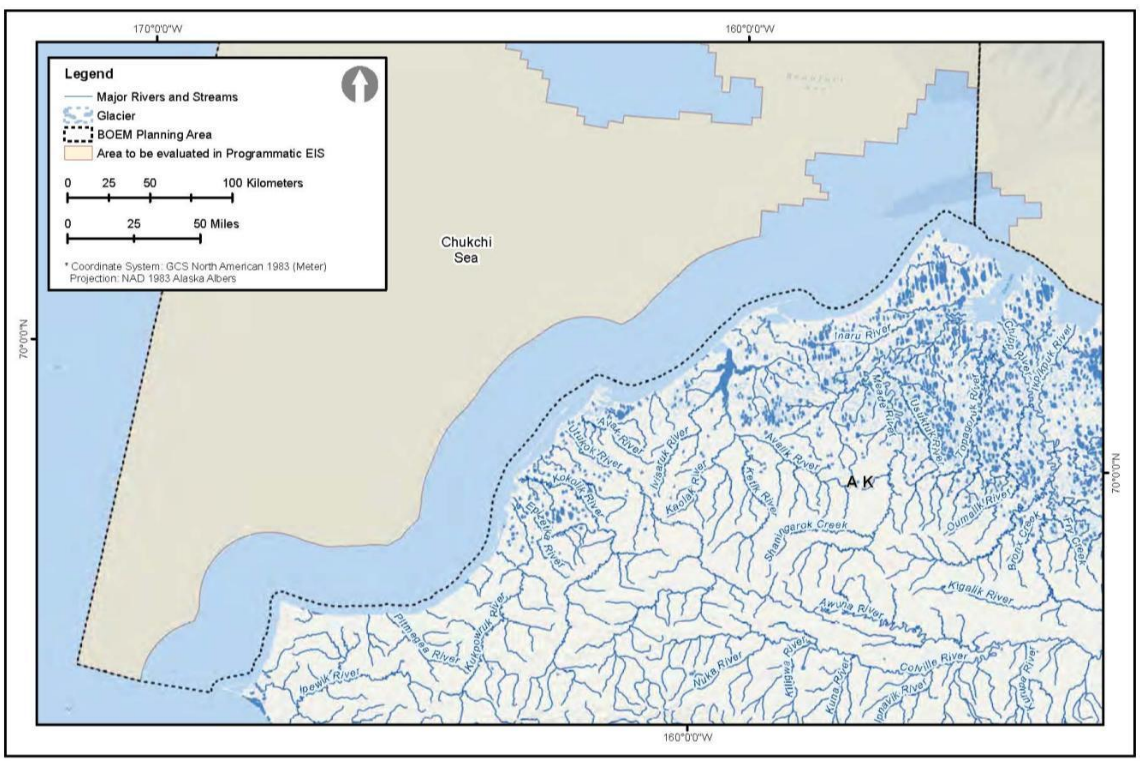


Figure C-20b. Major Rivers Entering the Beaufort Sea and Chukchi Sea Planning Areas (2 of 2).

4.1.1.7. Wetlands and Marshes

The Arctic coastal plain is dominated by wetlands, with some of the nation's most extensive complexes of salt marshes and mud flats occurring along the coasts of the Beaufort and Chukchi Seas. These are concentrated particularly at the deltas of the major rivers, and in a few protected bays. Large estuarine wetland complexes are found just south of Point Hope, extending eastward along the coast to Harrison Bay in the Beaufort Sea. These coastal marshes are intertidal wetlands exposed at low tides and inundated by high tides and storm surges. Freshwater wetlands also occur in this region, but are located outside of the area to be evaluated in this Programmatic EIS and are not described. In the Beaufort Sea and Chukchi Sea Planning Areas coastal salt marshes are generally smaller, often only a few meters in extent, and less common than on the south Alaskan coast due to disturbance from sea ice and the small tidal amplitude (Viereck et al., 1992).

The predominant community types of Arctic coastal salt marshes are dense halophytic (salt-tolerant) sedge wet meadow communities and sparse halophytic grass wet meadow communities. The former occur where tidal inundation ranges from several times per month to once a summer, while the latter occur at lower elevations under regular or daily inundation from tides and are subject to sea ice disturbance. Soils are fine-textured silts and clays, often overlying sand or gravel within the halophytic wet meadow communities (Viereck et al., 1992; Funk et al., 2004).

The most important coastal estuarine wetlands along the Beaufort Sea coast include Elson Lagoon, just east of Point Barrow; Admiralty Bay; Smith Bay; Harrison Bay; Fish Creek Delta; Colville River Delta; Simpson Lagoon; Canning River Delta; Jago Lagoon–Hulahula River Delta; and Demarcation Bay (Hall et al., 1994). Coastal wetlands (salt and brackish marsh) represent four percent of the Beaufort Sea coastline (**Figure C-19**).

Non-vegetated intertidal wetlands are found along the Chukchi Sea shoreline. Estuarine wetland systems, including sand/silt flats and brackish-water sedge marshes, occur in enclosed and protected bays and lagoons along the Chukchi Sea shoreline, including Marryat Inlet, Aiautak Lagoon, Omalik Lagoon, Kasegaluk Lagoon, Icy Cape, Peard Bay, Wainwright Inlet, and Point Hope (Hall et al., 1994). During the summer, many animals concentrate around the passes between the ocean and the shallow lagoons. Point Lay/Kasegaluk Lagoon coast/Ledyard Bay is an important region for marine mammals as well as seabirds. Many marine mammals also use this region either as a migratory corridor or for feeding (Hopcroft et al., 2008). Coastal wetlands (salt and brackish marsh) represent 34 percent of the Chukchi Sea coastline (**Figure C-18**).

Alaska's wetlands provide many benefits including food and habitat for wildlife, fish and shellfish species, natural products for human use and subsistence, shoreline erosion and sediment control, flood protection, and opportunities for recreation and aesthetic appreciation (Hall et al., 1994).

4.1.1.8. Submerged Aquatic Vegetation

Nearshore areas of the Beaufort and Chukchi Seas are relatively deep and are generally unvegetated. Dense marine algal communities occasionally grow in protected, shallow nearshore subtidal areas with approximate depth <11 m [36 ft]) with hard substrates, as behind barrier islands and shoals (USDOI, BOEM, 2012). The distribution and extent of these communities are likely limited by the availability of rock and other hard substrates.

Marine algal communities occur on hard bottom substrates in several areas along the Chukchi Sea coast such as in Peard Bay, which has an extensive kelp community, Kasegaluk Lagoon, Skull Cliffs and southwest of Wainwright (Dunton et al., 2004; Phillips et al., 1984). Few known beds occur along the Beaufort Sea coast; however, the Stefansson Sound Boulder Patch has the largest brown kelp (*Laminaria solidungula*) community in the U.S. Arctic (Dunton et al., 2004).

4.1.2. Cook Inlet Planning Area

4.1.2.1. Coastal and Estuarine Habitats

Coastal and estuarine habitats along the shoreline of Cook Inlet are discussed below. Use of Alaskan habitats by birds, wildlife, fish, and other marine life is discussed in other sections of this Programmatic EIS.

The Cook Inlet Planning Area is located in south-central Alaska. The physiography of this region includes rocky coastlines and numerous fjords, islands, and embayments (Wilkinson et al., 2009). Large salt marshes and mud flats dominate the coast along Cook Inlet, particularly along the western shore, although sand and gravel beaches, and rocky shores are also quite common at more exposed locations (Lees and Driskell, 2004). Coastal habitats of Cook Inlet are featured in **Figure C-21**.

The Cook Inlet Planning Area also includes several significant water bodies and embayments, with Kamishak Bay and Kachemak Bay in the lower inlet, and many smaller bays and coves (Foster et al., 2010). Several major river systems flow into Cook Inlet and influence habitats there (**Figure C-22**). There are no barrier islands in the Cook Inlet.

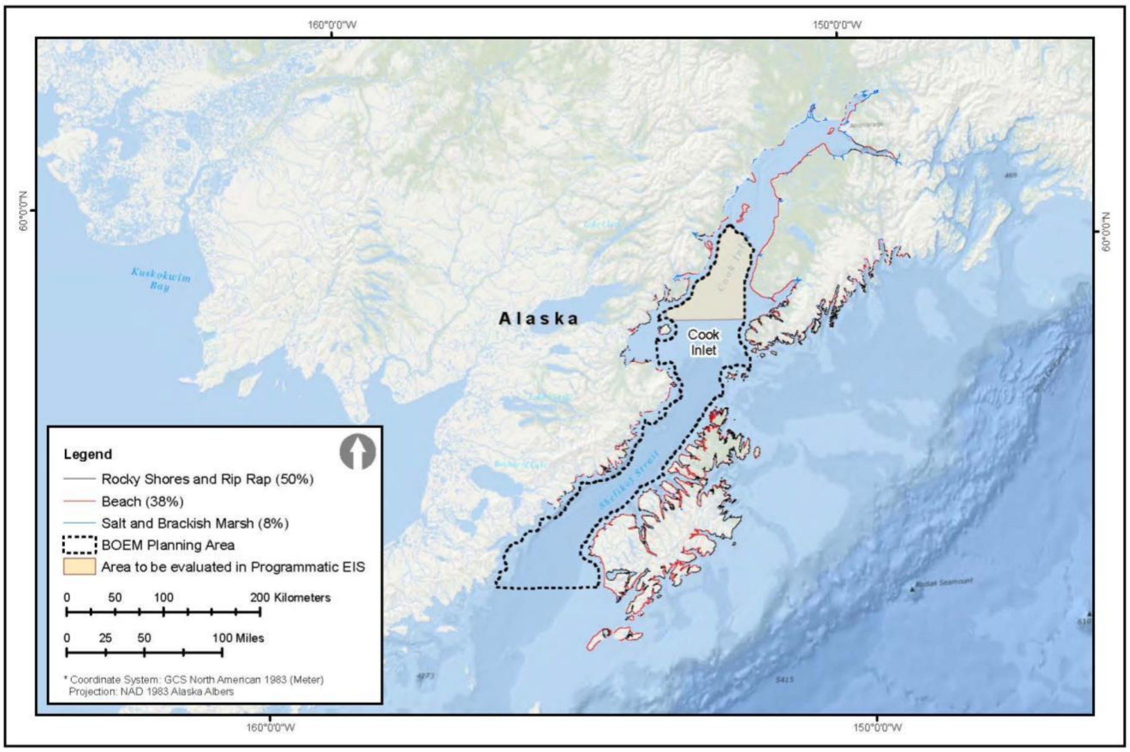


Figure C-21. Coastal and Estuarine Habitats of the Cook Inlet Planning Area (From: USDOC, NOAA, ORR, 2015).

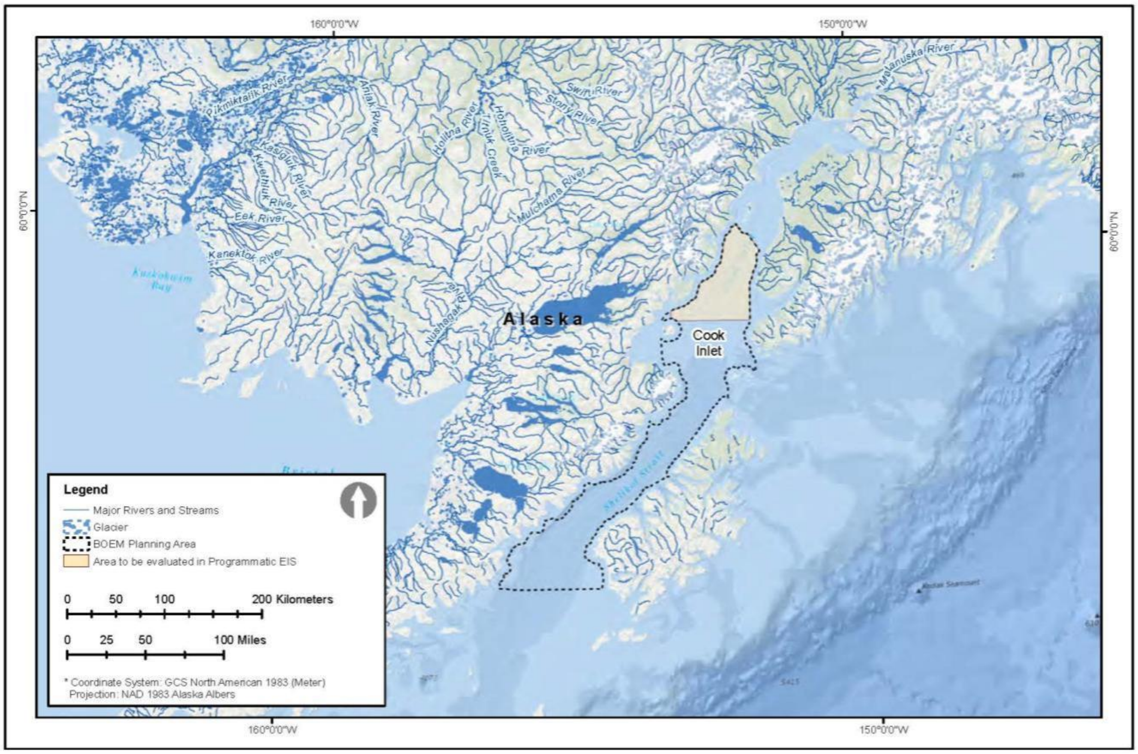


Figure C-22. River Systems and Rivers Entering Cook Inlet.

4.1.2.2. Beaches

In Cook Inlet, 38 percent of the shoreline is beach habitat (**Figure C-21**). Lake Clark National Park and Preserve , located on the western shore of Cook Inlet, is dominated by long stretches of very exposed sandy beaches, characterized by fine sand and sandy silt (Lees and Driskell, 2006). Boulder and cobble beaches, cobble beaches, or broad sandy flats dominate the exposed shoreline between Chinitna and Tuxedni Bays, while the shoreline between Tuxedni Bay and Redoubt Point comprises broad sandy beaches. The sandy beaches support burrowing organisms including extensive populations of Pacific razor clam (*Siliqua patula*), Baltic macoma (*Macoma balthica*), and surf clams.

4.1.2.3. Tidal Flats

In the vicinity of Lake Clark National Park and Preserve, the exposed western shore of the Cook Inlet Program Area is dominated by extensive sand flats, which support a robust population of Pacific razor clams. The more protected embayments, including Tuxedni and Chinitna Bays, are dominated by mud flats, which support a robust population of softshell clams and Baltic macomas, and provide critical habitat to migrating western sandpiper (*Calidris mauri*) and dunlins (*Calidris alpina*) during spring migration (Lees and Driskell, 2006; Bennett, 1996). Tidal flats are also found at the mouths of Anchor River, Deep Creek, and Kasilof River, and surrounding Kalgin Island (USDOC, NOAA, 2002).

4.1.2.4. Rocky Shores

There are several rocky shore features, including beach rubble, boulders, rocky ledges, and cliff faces, located on both the eastern and western shore of Cook Inlet. These habitats provide critical nesting sites for many seabirds. Important nesting sites in Cook Inlet include Chisik Island and Duck Island, located near Tuxedni Channel; and Gull Island, located in Kachemak Bay outside the lease sale area (USDOC, NOAA, 2002). These areas represent 50 percent of the Cook Inlet coastline (**Figure C-21**).

4.1.2.5. Tidal Rivers

Three major river systems discharge into upper Cook Inlet: the Knik, Matanuska, and Susitna Rivers (**Figure C-22**). These three rivers have peak flows that, combined, represent approximately 70 percent of the total freshwater input into the inlet, and they carry tons of suspended sediment into the inlet each year. The high suspended sediment loads that enter upper Cook Inlet via river discharges are confined mainly to the west, and influence nearshore geomorphology and the habitats available for nearshore plants and animals along the western bank (Foster et al., 2010).

Seven major streams enter the lower Cook Inlet from the eastern side: the Kenai River, Kasilof River, Crooked Creek, Ninilchik River, Deep Creek, Stariski Creek, and Anchor River (**Figure C-22**). These provide estuarine and freshwater habitats for several anadromous and migratory species including all five species of Pacific salmon, Dolly Varden char (*Salvelinus malma*), and steelhead trout (*O. mykiss*) (Alaska Department of Fish and Game [ADFG], 2014). The river systems entering Cook Inlet from the western side are smaller, and include Harriet Creek, Redoubt Creek, Polly Creek, and the Crescent River.

4.1.2.6. Wetlands and Marshes

Wetlands in Alaska comprise bogs, muskegs, wet and moist tundra, fens, marshes, swamps, mud flats, and salt marshes. Salt marshes and other wetlands occur throughout the coastal margins of the Cook Inlet (ADNR, 1999). Intertidal wetlands include unvegetated rocky and soft sandy or muddy sediment shores, as well as coastal salt marshes with emergent vegetation, and wetlands with submerged or floating vegetation. Coastal salt marshes commonly occur on soft sediments along low-energy shorelines. These wetlands are all periodically inundated or exposed by tides (McCammon et al., 2002).

Extensive freshwater marshes and salt marshes composed of sedge and grass wet meadow communities occur on river deltas along the coast. These communities are not generally inundated by tides, but may be flooded during storm surges. Upper areas of coastal marshes may also support a hairgrass (*Deschampsia* spp.) community (ADNR, 1999).

Inland marshes often include taller and denser communities of salt-tolerant sedges. Brackish ponds occasionally occur within coastal marshes of deltas, tidal flats, and bays. These shallow water communities are periodically inundated by tides (Viereck et al., 1992).

Other freshwater wetlands occur in this region, but are located outside of the area to be evaluated in this Programmatic EIS and are not described.

Coastal wetlands and marshes represent 8 percent of the Cook Inlet coastline (**Figure C-21**). This habitat provides food and habitat for wildlife, fish and shellfish species, natural products for human use and subsistence, shoreline erosion and sediment control, flood protection, and opportunities for recreation and aesthetic appreciation (Hall et al., 1994).

4.1.2.7. Submerged Aquatic Vegetation

Submerged or floating vegetation in Cook Inlet includes eelgrass and marine algae communities. Along much of the coast of the Gulf of Alaska, eelgrass communities are common in protected bays, inlets, and lagoons with soft sediments, while marine algal communities often occur in the low intertidal zone (<5 m [16 ft]) along exposed rocky shores. Along the shoreline of Cook Inlet, coastal salt marshes and mud flats contain large beds of eelgrass. Eelgrass serves as spawning and nursery sites for schools of Pacific herring (*Clupea pallasii*), and some salmon. Marine algae communities dominate the low intertidal areas, to approximately 3 m (10 ft) in depth (Viereck et al., 1992; McCammon et al., 2002).

Giant kelp and bull kelp form vast forests in shallow subtidal areas along much of the Gulf of Alaska's coast (Wilkinson et al., 2009). Within outer Kachemak Bay, kelp beds with both dense canopy and understory layers extending to depths of 18 m (59 ft) are widespread and support well-developed assemblages of sedentary invertebrates. North of Kachemak Bay as far as Anchor Point, on the east side of Cook Inlet, moderately developed kelp beds extend to shallower depths and display a thinner canopy and a more moderate understory, but still have well-developed assemblages of sedentary invertebrates (Foster et al., 2010).

4.2. GULF OF MEXICO PROGRAM AREA

This section describes coastal and estuarine habitats in the Gulf of Mexico Program Area, including the Western Planning Area, Central Planning Area, and Eastern Planning Area (Figure 2.1-2 in the Programmatic EIS).

Habitats adjacent to the Gulf of Mexico are considered either coastal or marine. Coastal habitats include the estuarine areas along virtually the entire U.S. coast of the Gulf of Mexico. Marine habitats occur seaward of these coastal habitats. The most seaward coastal feature, typically barrier islands or beaches in the Gulf of Mexico, serves as a convenient boundary between coastal and marine habitats, but the actual boundary between predominantly coastal and predominantly marine habitats is a transition zone blurred by the influence of estuarine discharges onto the continental shelf (USDOI, BOEM, 2012b).

Gulf of Mexico coastal habitats are associated with a nearly continuous estuarine ecosystem comprising 31 major estuarine watersheds that extend across the northern Gulf of Mexico. Coastal and nearshore habitats of concern include barrier islands and beaches, wetlands including marsh, bottomland swamp, mangrove, and scrub/shrub communities, and seagrasses. These habitats occur within estuarine watersheds in and around bays, lagoons, and river mouths, where seawater and freshwater intermix. In some areas, these habitats extend further offshore, to depths of approximately 30 m (98 ft). For the purposes of this document, 3 nmi (5.6 km) offshore is considered the boundary between "coastal" and "offshore" Gulf of Mexico regions.

While OCS activities would not be expected to extend upstream into the terrestrial portion of the watershed, terrestrial watershed characteristics influence estuarine habitats in important ways. Terrestrial discharges introduce dissolved and suspended materials into estuarine and marine waters that can serve either as nutrients that enrich marine and coastal productivity, or as pollutants that degrade habitat quality. Terrestrial discharges also transport suspended load and bedload sediments from land into estuarine areas, where they are redistributed through the coastal zone providing substrate for many habitats. Marine processes including waves, tides, and currents also are at work on the seaward side of estuarine areas. These processes affect the redistribution of terrestrial sediments in the coastal zone, coastal patterns of erosion and deposition, and mixing of freshwater and saltwater both within the coastal zone and onto the continental shelf. To large extent, variations in the interactions among these terrestrial and marine processes and properties distinguish the three coastal ecoregions that characterize the northern Gulf of Mexico (USDOI, BOEM, 2012b).

4.2.1. Seagrass Habitats

Seagrasses are a vital component of the Gulf of Mexico coastal ecology and economy (Dawes et al., 2004). Seagrasses provide a myriad of ecological services, sustaining food webs and providing habitat for marine life, particularly by supporting fisheries and providing critical habitat to other animals. Seagrasses maintain and improve water quality. They stabilize sediments and dampen wave activity, in turn preventing coastal erosion (Short et al., 2000; Dawes et al., 2004). Seagrasses are also important economically. On Florida's west coast, for example, seagrass beds are utilized by recreational boaters and fishers, and commercial fishers, directly bringing millions of dollars to the state (Bell, 1993; Dawes et al., 2004).

The seagrass environment in the Gulf of Mexico includes waters adjacent to five states: Texas, Louisiana, Mississippi, Alabama, and Florida, known collectively as the "Northern Gulf Region" (**Figure C-23**). The region comprises 2,414 km (1,500 mi) of coastline. Significant additional shoreline is located behind barrier islands or estuarine embayments along the coast (USEPA, Gulf of Mexico Program, 2004). The southwestern boundary of the Northern Gulf Region begins near Brownsville, Texas adjacent to the Western Planning Area, and extending clockwise terminates at the easternmost reaches of Florida Bay. It includes the northern boundary of the Florida Keys and the Dry Tortugas, within the southeast section of the Eastern Planning Area (Dawes et al., 2004; USEPA, Gulf of Mexico Program, 2004). The vast majority, 88 percent, of northern Gulf of Mexico seagrasses are found around Florida (Yarbro and Carlson, 2011).

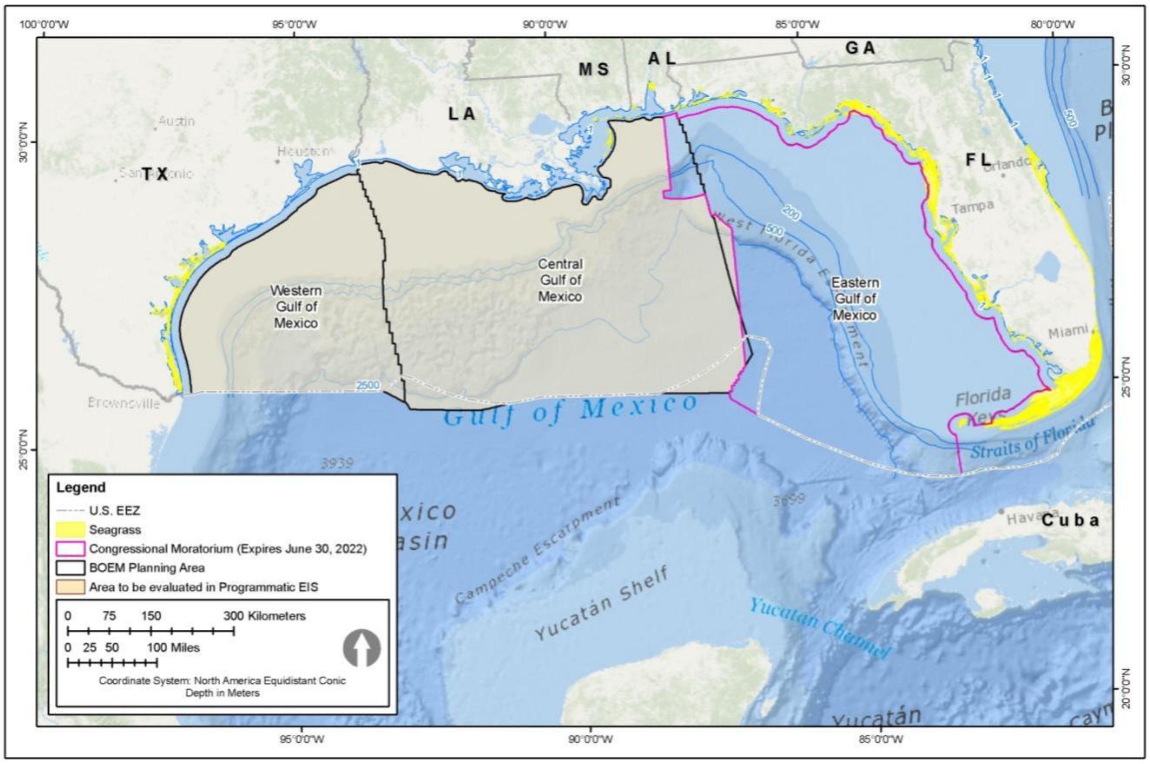


Figure C-23. Seagrass Distribution in the Gulf of Mexico.

The following discussion provides an overview of seagrass communities within or adjacent to the Western and Central Planning Areas. Seagrass habitats in the Eastern Planning Area also are discussed here; although most of it is under moratorium, the Eastern Planning Area contains or abuts the majority of the seagrass locations, and has potential for impact from non-routine OCS activities.

4.2.1.1. Western Gulf of Mexico Planning Area

Seagrasses in the western Gulf of Mexico are widely scattered beds in shallow, high salinity coastal lagoons and bays. Coastal waters off Texas harbor seagrasses with the second greatest areal extent of states bordering the Gulf of Mexico (11 percent, 92,854 ha [229,447 ac]). The majority (74 percent) of these are located in the broad shallows of the Laguna Madre (USDOI, BOEM, 2012b). Laguna Madre, along with other coastal bays in Texas, falls outside of the Gulf of Mexico Program Area, but these regions could be affected by anticipated activities in the OCS.

4.2.1.2. Central Gulf of Mexico Planning Area

Turbid waters and soft, highly organic sediments limit seagrasses in coastal Louisiana and within its bay and estuaries. However, one offshore area with an established seagrass community is located along the Chandeleur Islands. The northern end of the Chandeleur Chain is 35 km (22 mi) south of Biloxi, Mississippi; the southern end, Breton Island, is 25 km (16 mi) northeast of Venice, Louisiana. Turtle grass (*Thalassia testudinum*), manatee grass (*Syringodium filiforme*), shoal grass (*Halodule wrightii*), star grass (*Halophila engelmannii*), and widgeon grass (*Ruppia maritima*) occur in this region with seagrasses mapped on the western side of the Chandeleur Chain (Poirrier and Handley, 1940).

Louisiana's seagrass beds often are affected by storm events, with recovery times varying as a function of the size and severity of the disturbance (Franze, 2002; Fourqurean and Rutten, 2004). Over a period of 5 yr, three tropical cyclones made landfall near or on the Louisiana coast. These included Hurricane Humberto (2007), Tropical Storm Edouard (2008), and Hurricane Gustav (2008) (USDOI, BOEM, 2012a). These storms hit areas having a small amount of submerged vegetation. Hurricane Ida (2009) made landfall as a weakened tropical mass in Alabama, and this storm did not have any documented long-term effect on local submerged grass communities (USDOI, BOEM, 2012a). Some strong storm events removed significant amounts of submerged aquatic vegetation, and changed the nekton community structure. For example, in Biloxi Marsh Hurricanes Cindy (2005) and Katrina (2005) removed essentially all of the widgeon grass, and the post-storm nekton community resembled communities that had no vegetation prior to the hurricanes (Carlson et al., 2010; Maiaro, 2007).

In Mississippi and Alabama, seagrasses are present within Mississippi Sound (USDOI, BOEM, 2012b). A study by Byron and Heck (2006), that followed the passage of Hurricane Ivan, resurveyed stations that previously had been surveyed by Vittor and Associates (2003), while groundtruthing the areal extent and type of seagrasses in three zones of interest – Grand Bay, Mobile Bay (including Mississippi Sound east of Grand Bay), and Perdido Bay. Shoal grass was the most common seagrass, and widgeon grass was also prevalent (Byron and Heck, 2006). Additionally, by 2002, turtle grass was reported for the first time in Little Lagoon, Alabama (Vittor and Associates, 2003); its presence was reconfirmed by Byron and Heck (2006).

4.2.1.3. Eastern Gulf of Mexico Planning Area

Seagrass regions in the Eastern Planning Area are outside of potential routine impacts and therefore are not described in detail, but the major monitoring regions are listed:

- The northern Big Bend region extends from the mouth of the Ochlockonee River in the west to the mouth of the Steinhatchee River in the southeast. The northern Big Bend region contained at least 60,355 ha (149,140 ac) of seagrass, based on aerial imagery collected in 2006 (Yarbro and Carlson, 2011).
- The southern Big Bend region extends from the mouth of the Suwannee River north to the mouth of the Steinhatchee River. The southern Big Bend region contained 22,721 ha (56,146 ac) of seagrass cover during its latest assessment in 2006 (Carlson et al., 2010), an almost 6 percent decrease since the previous 2001 assessment, when coverage totaled 24,149 ha (59,674 ac) (Yarbro and Carlson, 2011).
- The Suwannee Sound, Cedar Keys, and Waccasassa Bay region extends south from the mouth of the Suwannee River to just south of the mouth of the Waccasassa River. The latest aerial assessment to be analyzed for this region was performed in 2001. Based on that effort, approximately 72 percent of seagrass beds are located in Waccasassa Bay, with 9,787 ha (24,184 ac) of seagrass.
- The Springs Coast region extends from the mouth of Crystal River in Citrus County south to Anclote Key, in northern Pinellas County. The Springs Coast region contained at least 153,380 ha (379,010 ac) of seagrass as of 2007.
- Persistently overlooked in seagrass census for the eastern Gulf of Mexico is the vast acreage of offshore and deepwater paddlegrass (*Halophila decipiens*) and star grass beds stretching from the Tortugas Bank to the Florida Panhandle, covering essentially the entire west coast of Florida. The majority of the resource is located in waters >10 m (33 ft) deep, and deeper, mostly beyond the limits of standard remote sensing detection techniques that are based on reflected light. Most of this habitat lies outside state waters, explaining why it is not included in Florida's totals.

> Nonetheless, early work supported by MMS found that more than 485,000 ha (1.2 million ac) of offshore *Halophila* spp. existed in the area north of Tarpon Springs, extending to the eastern end of St. George Bay, and approximately 1.2 million ha (3 million ac) existed to approximately 40 to 60 km (25 to 37 mi) offshore, and to lesser distances south of Sanibel Island to the Dry Tortugas (Continental Shelf Associates, Inc., 1986, 1987). These surveys did not cover the entire breadth of the *Halophila* habitat, which in the latter area extends to depths of 30 m (98 ft) (Fonseca et al., 2008).

Deepwater Horizon **Explosion, Oil Spill, and Restoration Regarding Seagrasses**

Studies in the peer-reviewed literature related to direct impacts of the spill to seagrasses are still scarce. The majority of aquatic vegetation that has been affected directly appears to be emergent vegetation associated with wetlands, and this subject is addressed in **Section 4.2.2**. It should be noted that aerial photography was collected on seagrass beds in the vicinity of Breton Island, the Chandeleur Islands, and Mississippi Sound (MC 252 SAV TWC, 2012) to assess their condition as part of the NRDA. Results of this effort do not appear to have been published yet in a peer-reviewed journal.

Indirect impacts to seagrasses did occur from spill response activities, and these included injuries from propeller scarring of seagrass beds by response vessels deploying and anchoring spill boom curtains in shallow waters, by propeller scarring from response vessels, and by scouring from boom curtains and anchor tethers. NOAA (2011) authorized some preliminary restoration work for these indirect impacts. Indirect impacts were documented and subsequent restoration efforts were carried out in specific regions along the Florida Panhandle.

4.2.2. Wetlands

Wetlands are essentially low-lying habitats where water accumulates long enough to affect the condition of the soil or substrate and to promote the growth of wet-tolerant plants (LaSalle, 1998). Because of their importance, wetlands are protected by federal, state, and in some cases, local laws. From a regulatory standpoint, a wetland is defined as: "Those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions" (EPA, 40 CFR 230.3 and CE, 33 CFR 328.3).

Wetlands are important, providing a number of ecological benefits (**Table C-6**). In the Gulf of Mexico, wetlands can help prevent downstream flooding after heavy rainfalls, or storm surges associated with tropical storms and hurricanes, common occurrences. From an economic standpoint, wetlands in the Gulf of Mexico provide large-scale opportunities for commercial and recreational activities.

Table C-6. Ecological Benefits Provided by Wetlands.

Wetland Action	Ecological Benefit
Filters pollutants and excess nutrients	Protects water quality (Gosselink et al., 1974)
Decreases amount of sediments and pollutants entering downstream bodies	Stabilizes shorelines (Barbier et al., 2011)
Stores water	Helps prevent downstream flooding after heavy rains and storm surges associated with storms and hurricanes
Attenuates storm wave and wind energy	Lessens storm damage (Stedman and Dahl, 2008)
Wetland ecosystem	Provides habitat for floral and faunal species, including some that are endangered
Many important gamefish spend a portion of their life histories in or near a coastal wetland habitat	Essential to health of commercial and recreationally important fisheries

Two broad classifications of wetlands occur within the Gulf of Mexico: inland and coastal. Inland wetlands are typically found within floodplains along rivers and streams, in isolated depressions surrounded by dry land, and in other low-lying areas. Inland wetlands generally include freshwater ecosystems such as bottomland hardwood forests, swamps, freshwater mangrove swamps, and freshwater marshes (Goodwin and Neiring, 1974).

Coastal wetlands are usually intertidal habitats, located at the interface between terrestrial and coastal water environments so they are influenced by bi-directional forces at their seaward and landward sides (Battaglia et al., 2012; USDOI, BOEM, 2012b) (**Figure C-24**). Across this boundary, plants are positioned based primarily on their tolerances to gradients in salinity and inundation, sulfide concentrations, and substrate stability (Baldwin and Mendelssohn, 1998). The most common coastal wetlands include saltwater mangrove swamps, saltwater marshes, and non-vegetated areas such as sand bars, mud flats, and shoals (Gulf Restoration Network, 2004).

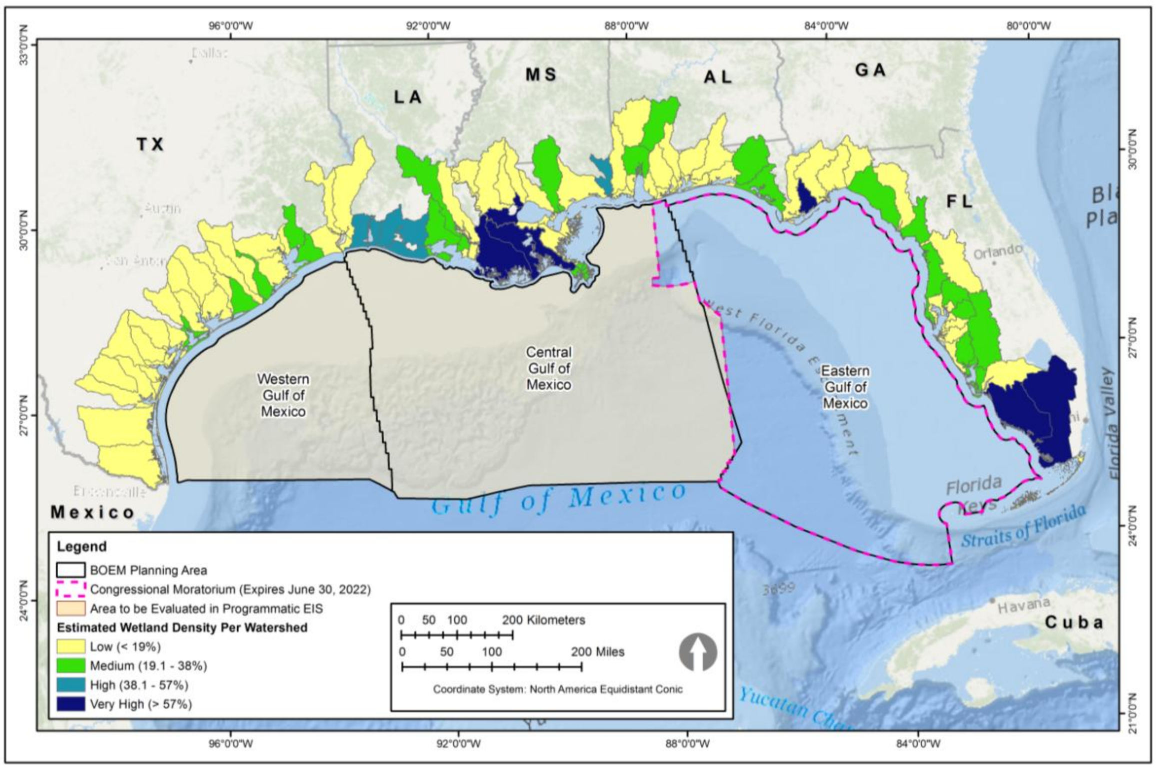


Figure C-24. Coastal Wetlands Adjacent to the Gulf of Mexico.

The vegetated coastal wetlands are primarily emergent, which Cowardin (1979) described as "characterized by erect, rooted, herbaceous hydrophytes, excluding mosses and lichens, present for most of the growing season in most years" (Handley et al., 2012). Plant species in the Gulf of Mexico's coastal emergent wetlands include smooth cordgrass (*Spartina alterniflora*), Gulf cordgrass (*Spartina spartinae*), salt meadow cordgrass (*Spartina patens*), and saltgrass (*Distichlis spicata*) (Handley et al., 2012). Mangrove swamps also are a common emergent wetland, particularly around Florida., inhabited by one or more members of the three mangrove species found in the Gulf of Mexico region – red mangrove (*Rhizophora mangle*), black mangrove (*Avicennia germinans*), and white mangrove (*Laguncularia racemosa*). Black mangroves have expanded their range and are established in the Central Planning Area.

The following brief discussion provides an overview of wetland regions within or adjacent to the Western Planning Area and the Central Planning Area. The Eastern Planning Area abuts a significant amount of wetland habitat and although it does not fall within the Program Area, potential for impact exists there from anticipated OCS activities.

4.2.2.1. Western Gulf of Mexico Planning Area

The emergent coastal wetlands around the Gulf of Mexico vary topographically and ecologically, and different ecoregions have been delineated (USEPA, 2013b). The Western Gulf Coastal Plain comprises the coast of Texas (which includes Corpus Christi, Neuces Bay, Aransas Bay, and Galveston Bay) and the western half of Louisiana’s coast (which falls adjacent to Central Planning Area). This region is characterized by flat topography, plains, and grasslands, and contains a number of barrier islands, bays, peninsulas, marshes, lagoons, and estuaries (Handley et al., 2012).

Along the Texas coast, from the Mexican border to the Bolivar Peninsula, estuarine marshes occur in discontinuous bands around bays and lagoons, on the inner sides of barrier islands, and in the deltas and tidally influenced reaches of rivers. Salt marshes, dominated by smooth cordgrass, are evident at the mouths of bays and lagoons, in areas of higher salinity. Salt-tolerant species such as saltwort (*Batis maritima*) and glasswort (*Salicornia* spp.) are among the dominant species. Brackish water marshes, some of which are infrequently flooded, occur farther landward. Freshwater marshes occur along the major rivers and tributaries, lakes, and catchments (White et al., 1986). Broken bands of black mangroves also occur in this area (Brown et al., 1977; White et al., 1986; USDOI, BOEM, 2012). Mud and sand flats around shallow bay margins and near shoals increase toward the south as marshes decrease. Freshwater swamps and bottomland hardwoods are uncommon, and do not occur in the southern third of this coastal area (USDOI, BOEM, 2012).

4.2.2.2. Central Gulf of Mexico Planning Area

The Chenier Plain extends approximately from Sabine Lake to Vermillion Bay, and consists of a series of sand and shell ridges separated by progradational mudflats, marshes, and open water lakes (USDOI, BOEM, 2012). Few tidal passes are located along the Chenier Plain, so tidal movement of saline water is reduced. Salt marshes are not widely distributed on the Chenier Plain. They are generally directly exposed to Gulf of Mexico waters and are frequently inundated. Brackish marshes are dominant in estuarine areas and are the most extensive and productive in the Louisiana portion of this area. Salt meadow cordgrass is generally the dominant species (USDOI, BOEM, 2012b). Freshwater wetlands are extensive on the Chenier Plain. While tidal influence is minimal, these wetlands may be inundated by strong storms (USDOI, BOEM, 2012b).

The Mississippi Alluvial Plain encompasses the eastern half of Louisiana’s coasts including Barataria Bay, Terrebonne Bay, and the Mississippi Delta (USDOI, BOEM, 2012b; USEPA, 2013b). Extensive salt marsh and brackish marsh occurs throughout this coastal region, with intermediate and freshwater marsh systems occurring further inland (Handley et al., 2012; USDOI, BOEM, 2012b). Stands of expanding black mangrove are established in some high-salinity areas (Perry and Mendelssohn, 2009; Roth, 2009).

Most marshes around Mississippi Sound and associated bays occur as discontinuous wetlands associated with estuarine environments. The more extensive coastal wetland areas in Mississippi are associated with deltas of the Pearl River and Pascagoula River (USDOI, BOEM, 2012b). Marshes in Mississippi are more stable than those of either Alabama or Louisiana, reflecting a more stable substrate, and continued, active sedimentation (USDOI, BOEM, 2012b). In Alabama, most of the wetlands are located in Mobile Bay and along the northern side of Mississippi Sound. Forested wetlands are the predominant type of wetland along the coast of Alabama; large areas of estuarine marsh and smaller areas of freshwater marsh also occur (Wallace, 1996; USDOI, BOEM, 2012b). Major causes of marsh loss in Alabama have included industrial development, navigational dredging, natural succession, and erosion-subsidence (Roach et al., 1987; USDOI, BOEM, 2012b).

4.2.2.3. Eastern Gulf of Mexico Planning Area

Although the Eastern Gulf of Mexico is outside of the Program Area being evaluated, this resource is described to provide reference for evaluation of impacts from a catastrophic discharge event (CDE).

Florida's west coast comprises two ecoregions, the Louisianian in the north along the Florida Panhandle, and the West Indian in the south, along the length of the peninsula (Bailey, 1978; Handley et al., 2015). The Louisianian Ecoregion extends from Cedar Key north and west along the Florida Panhandle to the Alabama line. It is characterized by extensive emergent coastal wetlands, temperate fauna, small tidal ranges (<1 m [3 ft]), and low wave energy (Cowardin et al., 1979). The West Indian Ecoregion, ranging from Cedar Key to the Florida Keys, is characterized by tropical flora and fauna, including mangrove wetlands, small tidal ranges (<1 m [3 ft]), and low wave energy (Lewis, 1989).

Along Florida's west coast, coastal emergent wetlands are a large component of the coastline, and are most prevalent around the central Florida Panhandle, the Big Bend region, and southern Florida, near Collier County and the Ten Thousand Island region (Stedman and Dahl, 2008). The Big Bend region of Florida is dramatically different than the rest of Florida's sandy coasts, instead dominated by marshland of black needlerush (*Juncus roemerianus*), and shelly sand beaches (Florida Department of Environmental Protection [FDEP], 2010; USDOI, BOEM, 2013).

More extensive details on regional wetland characteristics are provided in the BOEM 2012 OCS Oil and Gas Leasing Program: 2012-2017 Final Programmatic EIS (USDOI, BOEM, 2012a), including specifics on wetland losses as a result of contributing factors including the effects of large storms, subsidence, sea-level rise, saltwater intrusion, drainage and development, canal construction, herbivory, sediment deprivation, reduced flooding, and induced subsidence and fault reactivation.

A number of coastal habitat protection and restoration projects have been initiated along the Gulf of Mexico coast to address the issue of erosion and attendant land losses, including more recent efforts associated with the 2012 RESTORE Act (Coastal Protection and Restoration Authority [CPRA], 2015). Many of these projects have focused on rebuilding barrier islands and coastal beaches for shoreline maintenance, as well as protecting coastal salt marshes. Modern techniques for navigation channel dredging and maintenance use dredged sediments to nourish adjacent coastal landforms, minimizing potential impacts of erosion. BOEM, in cooperation with state and local agencies, has been involved in developing habitat restoration projects using OCS sand resources.

Deepwater Horizon Explosion, Oil Spill, and Response: Regarding Wetlands

Environmental damage to wetlands was limited to marsh shorelines, and generally did not impact the interior marshes (Mendelssohn et al., 2012). An estimated 692 km (430 mi) of marsh shoreline were oiled, and a summary by Zengel and Michel (2011) reported that of those marsh shorelines, 41 percent (283 km [176 mi]) were either heavily or moderately oiled. Silliman, et al. (2012) found that in some heavily oiled Louisiana marshes, shoreline fringes helped contain oil from marsh interiors. There was extensive mortality to marsh plants from the marsh edge to 16.4 to 32.8 ft (5 to 10 m) inland, with sublethal impacts on plants 32.8 to 65.6 ft (10 to 20 m) from the shoreline, where oiling was less severe.

The primary marshes affected included: salt marshes dominated by smooth cordgrass, and black needlerush; mangroves, dominated by the black mangrove (*Avicennia germinans*); which were present on small islands and shorelines and as scattered stands within salt marshes; and low- to intermediate-salinity marshes, dominated by *Phragmites australis*, the common reed, along the margin of the Mississippi River Birdfoot Delta. Studies following the spill had shown variable impacts, depending on oiling severity (DeLaune and Wright, 2011; Mendelssohn et al., 2012; Silliman et al., 2012). Near-complete mortality of the two dominant species, smooth cordgrass and black needlerush occurred along heavily oiled shorelines, whereas moderate oiling had no significant effect on (*Spartina* sp.) smooth cordgrass despite lowering the living aboveground biomass and stem density of (*Juncus* sp.) black needlerush (Mendelssohn et al., 2012). DeLaune and Wright (2011), following extensive review of oil spill literature and related studies in the Gulf of Mexico, noted that marsh vegetation under most conditions will recover naturally from oil exposure without any need for remediation. Recovery rate will depend on the degree of oiling, the amount of oil penetrating the soil profile, and plant species' sensitivity to oil.

4.2.3. Coastal Barrier Landforms

Coastal barrier landforms consist of barrier islands, major bars, sand spits, and beaches that extend across the nearshore waters from the Texas-Mexico border to southern Florida. Coastal barrier islands are important resources that protect the mainland from harsh environmental conditions that may cause shoreline deterioration (Byrnes et al., 2013; Khalil et al., 2013; CPRA, 2014; Ford, 2014; USDOI, BOEM, 2015). Barrier islands are long, narrow islands composed largely of sand or other unconsolidated soils (Bagur, 1978), and usually are aligned parallel to shore (Zhang and Leatherman, 2011).

The U.S. Gulf of Mexico shoreline is approximately 2,623 km (1,631 mi) long, from the U.S.-Mexico border to southern Florida (National Atlas, 2013). Barrier islands are present on more than half of the coastline (LaRoe, 1976; USDOI, BOEM, 2015c). Barrier island beaches usually comprise a shoreface, foreshore, and backshore (Frey and Howard, 1969; USDOI, BOEM, 2012b; Society for Sedimentary Geology, 2013). The shoreface consists of the submerged substrate seaward of the low-tide water line; the foreshore is the unvegetated beach landward of the low-tide water line to the beach berm crest (USDOI, BOEM, 2012b). The backshore is the area between the beach berm crest and dunes, and may be sparsely vegetated. The berm crest and backshore may occasionally be absent due to storm activity. The dune zone of a barrier landform can consist of a single, low dune ridge, several parallel dune ridges, or a number of curving dune lines stabilized by vegetation. These elongated, narrow landforms are composed of wind-blown sand and other unconsolidated, predominantly coarse sediments.

The wave, wind, and tidal energy shape barrier islands, including their respective shorelines and sand dunes, creating a dynamic, ever-changing system (LaRoe, 1976; Zhang and Leatherman, 2011; USDOI, BOEM, 2012b). Storms can have dramatic impacts on low-lying barrier island beaches, often inducing overwash events even with small surges (Sherwood et al., 2014; USDOI, BOEM, 2015). Most of the geographic changes experienced by barrier islands are due to storms, subsidence, deltaic influence, longshore drift, or anthropogenic stressors (USDOI, BOEM, 2012b). Longshore movements of barrier island sand are important due to their role in creating estuarine environments in the lagoons between the island and the mainland. Most of the barrier islands in the Gulf of Mexico are migrating laterally to some extent (USDOI, BOEM, 2012b), although some of the beaches on the west coast of Florida are either stable or slowly accreting given typical low wave energy and frequent renourishment (Morton et al., 2005). Most Gulf of Mexico barrier islands also are migrating landward, resulting in the accumulation of marine sediments on top of terrestrial sediments (Khalil et al., 2013). These transgressive islands are usually low-profile, narrow, sparsely vegetated, and have frequent washover channels (USDOI, BOEM, 2012b). Landward migration of barrier islands is an inexact and discontinuous process that depends on numerous variable factors including storm frequency and intensity, cold front passage, and weather events (Williams et al., 1992).

4.2.3.1. Western Planning Area

The barrier island chain is well developed and nearly continuous from Brownsville to Galveston, Texas. Padre Island, Mustang Island, San Jose Island, Matagorda Island, and Galveston Island, the five major barrier islands of this region, are generally narrow, low-relief, and sediment-starved, due the localized nature of currents and resulting sediment transport (Paine et al., 2014). As sea level rises, shorelines along this section of the Gulf of Mexico’s coast have been transformed into transgressive landforms, effectively causing erosion and landward sediment movement (USDOI, BOEM, 2012b; Paine et al., 2014). In far eastern Texas and western Louisiana, the coastline is dominated by expansive marshlands with inland lakes, left by erosion during the last glaciations (USDOI, BOEM, 2012b). East to Atchafalaya Bay, Louisiana is primarily marshland, with no barrier island beaches.

4.2.3.2. Central Planning Area

The barrier islands of the northern Gulf of Mexico stretch from Atchafalaya Bay, Louisiana, to Mobile Bay, Alabama (USDOI, BOEM, 2012a; USDOI, BOEM, 2013). Beaches here are generally eroding and deterioration of barrier islands occurs as a result of reduced sediment availability and transport, SLR, frequent tropical and winter storms, and topographic and geomorphic features (Otvos and Carter, 2008; McBride et al., 1992; USDOI, BOEM, 2012a; Byrnes et al., 2013; Khalil et al., 2013; USDOI, BOEM, 2013; CPRA, 2014). Barrier islands off the coast of Louisiana, the Isle Dernieres Chain, Timbalier Island, Grand Isle, and the Chandeleur Islands, are highly influenced by the Mississippi River Delta (CPRA, 2014). Channelization of the Mississippi River deposits much of the available sediment offshore in deepwater, where it cannot be used to replace eroded beaches (USDOI, BOEM, 2012a). The major barrier islands of Mississippi and Alabama are Cat Island, Ship Island, Horn Island, Petit Bois Island, and Dauphin Island. These generally do not migrate landward as they accrete sediment. Instead, these islands are migrating westward by means of shoal-bar accretion due to the area's dominant westward littoral drift (USDOI, BOEM, 2012b). Shoal-bar accretion results in islands with high beaches and broad dunes. A noticeable exception is Dauphin Island, Alabama, a 12-km (7.5-mi) long, low-profile transgressive island that is slowly migrating landward as a result of frequent storm overwash that results in the deposition of sediment on the lee side of the island (Morton, 2008).

4.2.3.3. Eastern Planning Area

The west coast of Florida has two prominent areas with barrier island beaches. A semi-continuous chain of barrier islands from Perdido Key on the Alabama/Florida border, to Panacea, Florida dominates most of the Florida Panhandle coast. A long stretch of coastline without barrier island protection is present from Apalachee Bay near the Big Bend of Florida, to Anclote Key, just north of Tampa. South of Anclote Key, the barrier island chain continues south along the southwest edge of Florida ending at Ten Thousand Islands, on the edge of the Everglades. The barrier island beaches of Florida are low- to moderate-energy beaches with low relief and small dunes, composed mostly of quartz sand (Godfrey, 1976). Most of barrier island beaches in this region are wider and more stable than the eroding barrier islands of Mississippi, Alabama, and Texas (Otvos and Carter, 2008) and include wind-dominated and mixed energy islands that reflect the diversity of the energy availability on Florida's coasts (Hine et al., 2001).

4.3. ATLANTIC PROGRAM AREA

4.3.1. Mid-Atlantic Planning Area

4.3.1.1. Coastal and Estuarine Habitats

This section discusses the locations, extent, and physical attributes of coastal and estuarine habitats along the shorelines of Virginia and North Carolina that could be affected by spills within the Mid-Atlantic Planning Area (Figure 2.1-3 in the Programmtic EIS). The use of these habitats by birds, wildlife, fish, and other marine life is discussed in other sections of this Programmatic EIS.

The Atlantic coast from the Maryland-Virginia border to the North Carolina-South Carolina border is a nearly continuous line of barrier islands, beaches, sand spits and a few large embayments such as the Chesapeake Bay. Tidal inlets and bay entrances separate the long, low barrier islands from the mainland. Extensive wetlands exist behind the barrier islands (USDOC, NOAA and Association of State Floodplain Managers [ASFPM], 2007). Coastal habitats of the Mid-Atlantic are shown in **Figures C-25a** and **C-25b**.

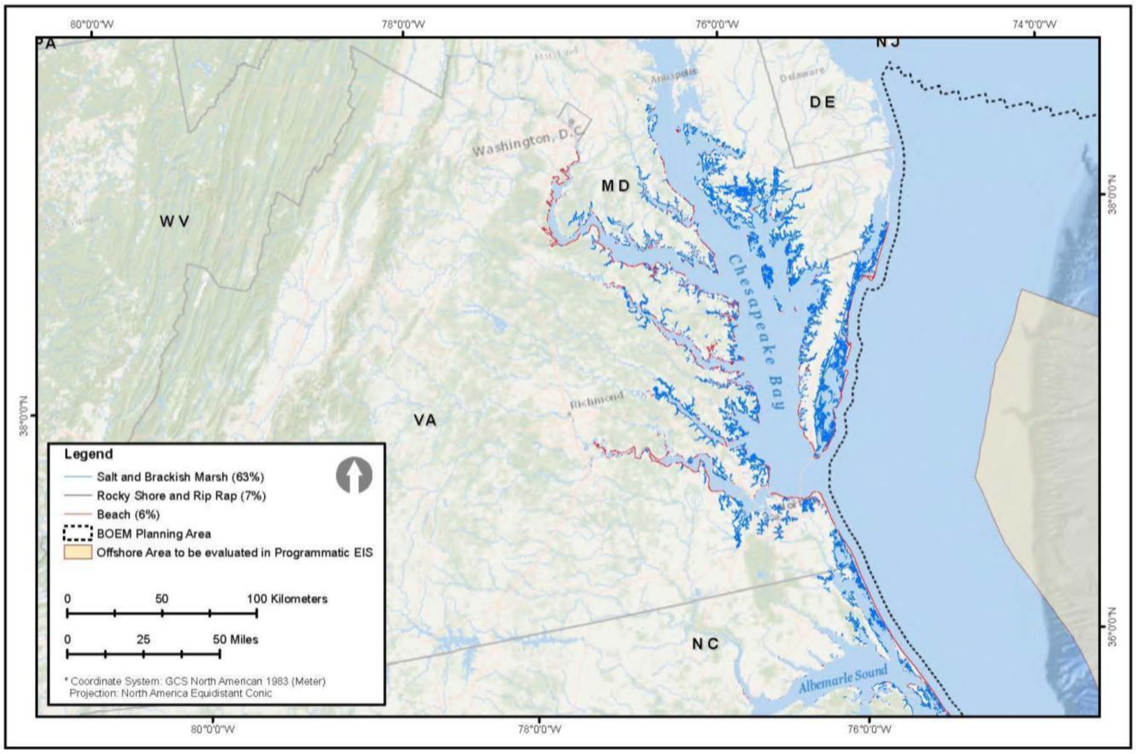


Figure C-25a. Coastal and Estuarine Habitats Adjacent to the Mid-Atlantic Planning Area (1 of 2) (From: USDOC, NOAA, ORR, 2015).

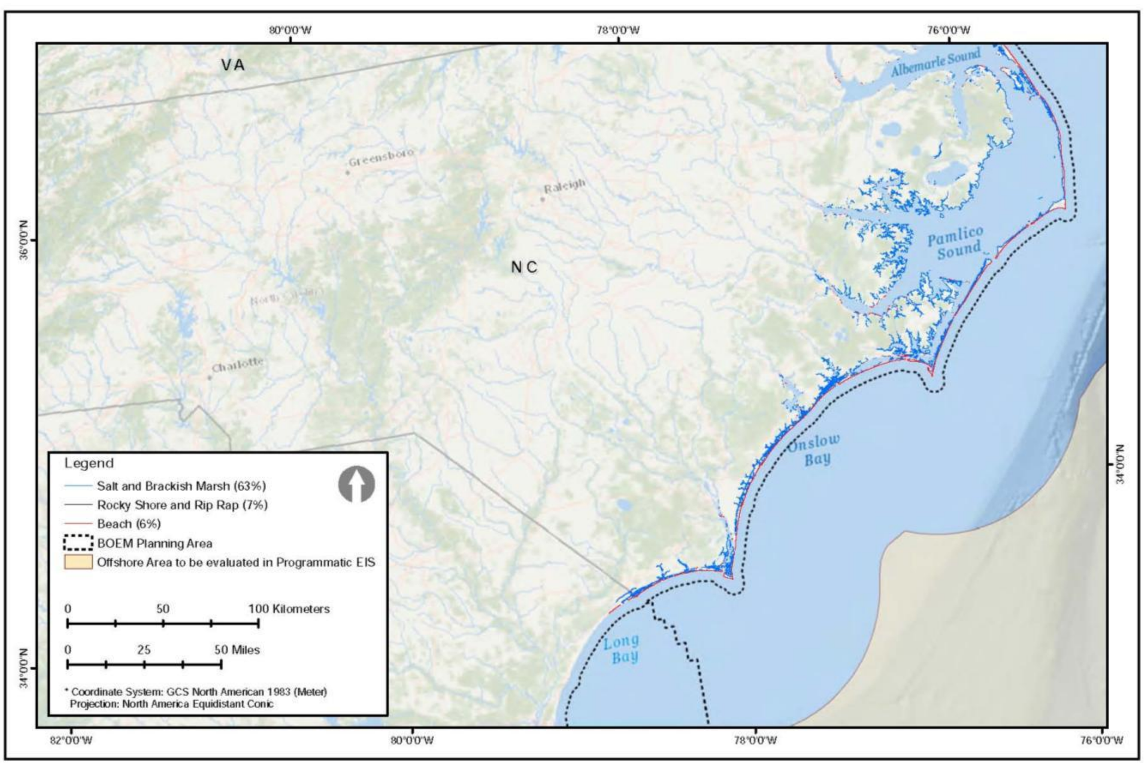


Figure C-25b. Coastal and Estuarine Habitats Adjacent to the Mid-Atlantic Planning Area (2 of 2) (From: USDOC, NOAA, ORR, 2015).

4.3.1.2. Barrier Islands

Barrier islands protect the mainland from wave and current action, especially during major storms and hurricanes. Wind, currents, and tides constantly change and reshape barrier islands. The shape of a barrier island is governed by the relative strength of these three forces.

Barrier islands provide natural habitat for plants and animals and serve as a recreational destination for locals and tourists. They also serve as an important habitat to migratory shorebirds. Some of the barrier islands in Virginia and North Carolina also provide nesting habitat to loggerhead sea turtles (*Caretta caretta*).

Fenwick Island and Assateague Island are large barrier islands, located off the eastern coast of Maryland. Tidal exchange with the ocean between the islands is limited to the inlet dividing Fenwick and Assateague Islands and another inlet in Virginia south of Chincoteague Island (Maryland Department of Natural Resources, 2004).

There are approximately 20 major barrier islands on the Virginia coast. From Assateague Island in Maryland/Virginia to Fisherman's Island in Virginia, these islands form a chain that follows the eastern shore of the Atlantic Ocean. They are composed of sand and are backed by marshes. South of the Chesapeake Bay, the barrier islands of Virginia are joined to the mainland from Cape Henry to Sandbridge, and reportedly are not actively migrating (Grimes, 2014). At Back Bay, a new chain of active barrier islands starts which leads into the main barrier islands of North Carolina.

Along the coast of North Carolina, the shoreline includes mainland beaches and a series of long narrow barrier islands sheltering salt marshes. Tidal inlets separate the islands and connect the embayments behind the islands to the ocean. The barrier islands referred to as the Outer Banks are one of the best-known features along the North Carolina coastline (USDOC, NOAA and ASFPM, 2007).

4.3.1.3. Beaches

Beaches are prevalent along the Mid-Atlantic Coast, occurring along the mainland and on barrier islands and isolated islands. The Assateague Island National Seashore includes >60 km (37 mi) of high-quality ocean beaches in Maryland and Virginia. In Virginia and North Carolina, 6 percent of the shoreline is mapped as beaches (see National Environmental Sensitivity Index [ESI] Shoreline maps in **Figure C-25a**). These beaches may be either sand or gravel. The beaches provide vital habitats for migratory birds using the Atlantic Flyway, nesting habitat to loggerhead sea turtles, and haulout locations for seals. Beaches also provide habitat for shellfish and other burrowing organisms. Various beach grasses and plants are found on the beach and dune areas and provide shade, cover, food, and nesting habitat for animals.

4.3.1.4. Tidal Flats

Tidal flats occur sporadically along the Virginia and North Carolina coastline. Tidal flats occur in the intertidal zone and are dynamic features of the coastal landscape that change with shifting sediment deposition and erosion patterns. They typically are composed of muddy substrates and have sparse or no vegetation (Strange et al., 2008). Characteristics of tidal flats are summarized in **Table C-7**.

Table C-7. Characteristics of Tidal Flats.

Physical and Biological Tidal Flat Components	Comments
Surface sediments	Support microscopic plants in top few mm that are an important source of estuarine primary production, e.g., diatoms, blue-green algae, dinoflagellates, and burrowing animals
Microfauna	e.g., small protozoa
Meiofauna	e.g., nematodes and copepods
Macrofauna	e.g., amphipods, polychaetes, mollusks, echinoderms, crustaceans
Fish species	e.g., spot and pinfish that feed on benthic invertebrates
Larger invertebrates	e.g., crabs, whelks, snails, shrimp that feed on benthic invertebrates
Critical foraging areas for birds	e.g., wading birds, migrating shorebirds, dabbling ducks (Strange et al., 2008; USDOC, NOAA, NOS, 2012)

4.3.1.5. Rocky Shores

Only 7 percent of the Virginia and North Carolina shoreline is rocky shore habitat (**Figures C-25a** and **C-25b**); however, there are a few armored areas. Rocky shores provide substrate for encrusting organisms and marine algae, cover for small marine animals, and feeding areas for fish, birds, and other wildlife.

4.3.1.6. Tidal Rivers

Tidal rivers, tidal streams, and estuaries are abundant along the mid-Atlantic coast. The major estuaries include Chesapeake Bay, Albemarle Sound, Pamlico Sound and their associated tidal rivers, the Cape Fear River, and the manmade Atlantic Intracoastal Waterway (**Figures C-26a** and **C-26b**). Chesapeake Bay is North America’s largest estuary (USDOC, NOAA, 2012b). The Chesapeake Bay watershed includes >165,696 km^2 (64,000 mi^2) in six states. This estuary, along with the other Mid-Atlantic estuaries, provides valuable services to plants, animals and people.

Tidal river or stream habitats contain both freshwater, and brackish water adjacent to the estuary or marine habitat at the river’s head. Tidal river and stream habitats are dynamic environments, and given both their freshwater and marine components, provide for a wide variety of aquatic, estuarine and marine communities. Variations in salinity, temperature and water clarity determine the flora and fauna that inhabit these environments. Tides promote the rise and fall of brackish water levels. If a saltwater wedge forms, certain species move up or down the river with the salt wedge. The estuarine area where a tidal river meets the ocean provides important nursery and habitat areas for a variety of fish, shellfish, birds, and other wildlife.

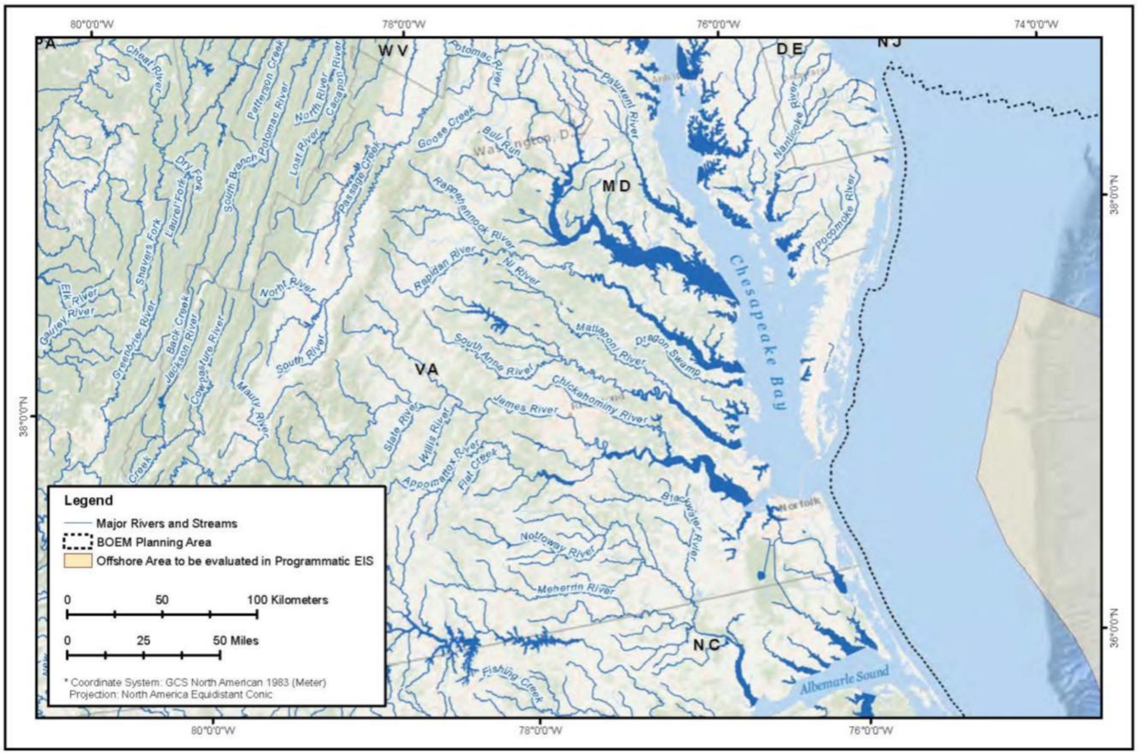


Figure C-26a. Major River Systems Entering Coastal Waters Adjacent to the Mid-Atlantic Planning Area (1 of 2).

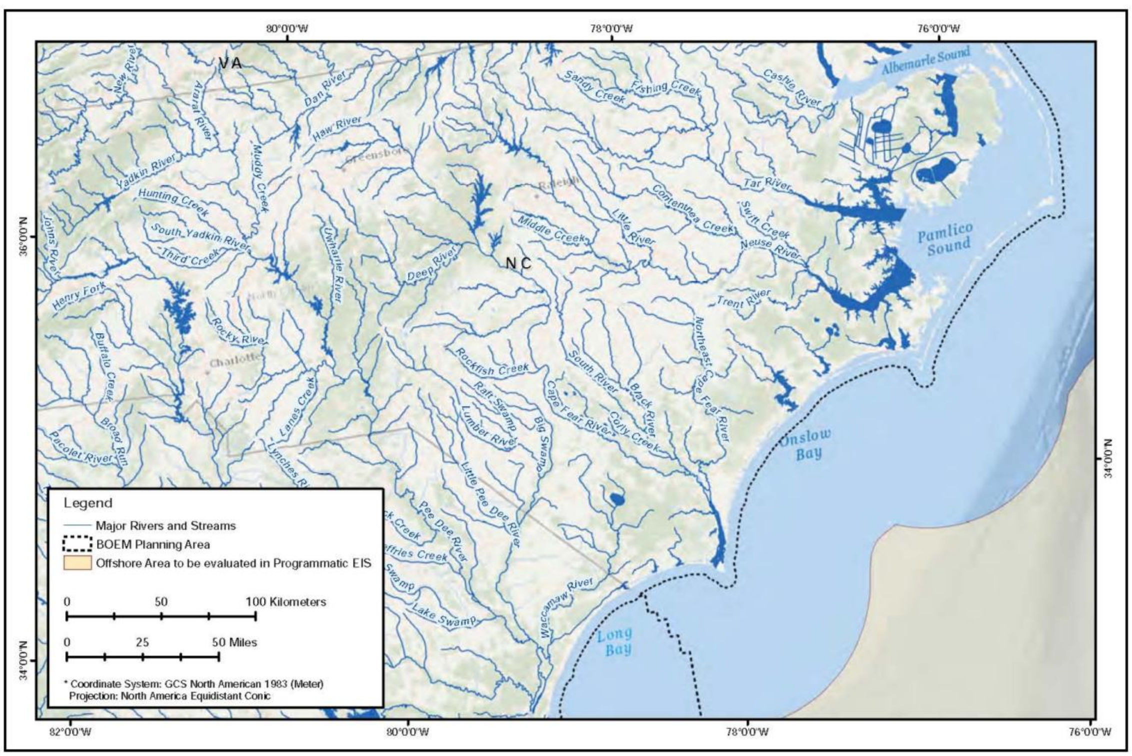


Figure C-26b. Major River Systems Entering Coastal Waters Adjacent to the Mid-Atlantic Planning Area (2 of 2).

4.3.1.7. Wetlands and Marshes

Mid-Atlantic wetland habitats include salt marshes and brackish water marshes. Freshwater and forested wetlands occur in this region, but they are not located in the area evaluated in this Programmatic EIS, and are not described here.

Salt marshes and brackish water marshes occur extensively in the mid-Atlantic. In Virginia and North Carolina, 63 percent of the shoreline is mapped as salt and brackish water wetlands and marshes (**Figures C-25a** and **C-25b**). These marshes occur on protected shorelines and on the edge of estuaries, including the inland-side of barrier islands. Brackish to freshwater marshes extend inland along estuaries where rivers meet the ocean.

In this region, salt marsh vegetation is typically dominated by smooth cordgrass which thrives on the outer edge of the marsh, and salt meadow cordgrass which thrives in higher marsh elevations. Above this zone, saltgrass and black needlerush grow in the driest, saltiest areas of the marsh (USDOC, NOAA, NOS, 2012).

Salt and brackish water marshes are one of the most productive ecosystems on the planet and are a primary source of organic matter and nutrients that form the base of the estuarine food web (Strange et al., 2008), and serve a variety of important functions (**Table C-8**).

Table C-8. Important Functions of Salt Water and Brackish Water Marsh Ecosystems.

Regarding Water Quality	• Buffer against storm damage, floods, waves, and sea level rise • Improve water quality by filtering and removing terrestrial pollutants and nutrients • Stabilize shorelines and minimize upland erosion
Regarding Biota	• Act as nursery for fish and shellfish, providing food, shelter, and spawning habitat • Provide nesting and foraging habitat for birds, including migratory birds, and other wildlife
Socioeconomic Services	• Support recreational uses, including tourism, hunting and fisheries

4.3.1.8. Submerged Aquatic Vegetation

Seagrasses occur on the sound side of many of the barrier islands and in estuaries in Virginia and North Carolina. They are graphically displayed as patchy or continuous beds (**Figures C-25a** and **C-25b**). In this region, common seagrass species include eelgrass (*Zostera marina)*, widgeon grass, and shoal grass. Eelgrass and widgeon grass are found in Chincoteague Bay and Chesapeake Bay in Maryland and Virginia, and eelgrass and shoal grass are both found in the Cape Lookout area in southern Core Sound, North Carolina (Appiott et al., 2011).

Seagrasses in this region grow in shallow, subtidal or intertidal unconsolidated sediments in areas that have good water clarity. They are considered submerged wetlands and form highly productive ecosystems that filter water, protect shorelines from erosion, and provide nursery habitat for many fish and shellfish species.

4.3.2. South Atlantic Planning Area

4.3.2.1. Coastal and Estuarine Habitats

This section discusses coastal and estuarine habitats along the shorelines of South Carolina and Georgia that potentially could be affected by spills within the South Atlantic Planning Area (Figure 2.1-3 in the Programmatic EIS). Use of these habitats by birds, wildlife, fish, and other marine life is discussed in other sections of this Programmatic EIS.

The coastlines of South Carolina and Georgia generally include a diverse range of low-relief coastal and estuarine habitats, including barrier islands, sandy beaches, tidal flats, estuarine bays and sounds, and marshland.

In South Carolina, the coast includes mainland beaches and a series of long barrier islands that shelter salt marshes. Numerous tidal inlets separate the islands and connect the sounds behind them to the ocean. The Grand Strand is one of the best known of these features in South Carolina.

South of Charleston, South Carolina to the mouth of the St. Johns River in Jacksonville, Florida, there are numerous short barrier islands, separated by large tidal inlets and backed by wide tidal marshes (USDOC, NOAA and ASFPM, 2007).

Coastal habitats adjacent to the South Atlantic Planning Area are shown in **Figure C-27**.

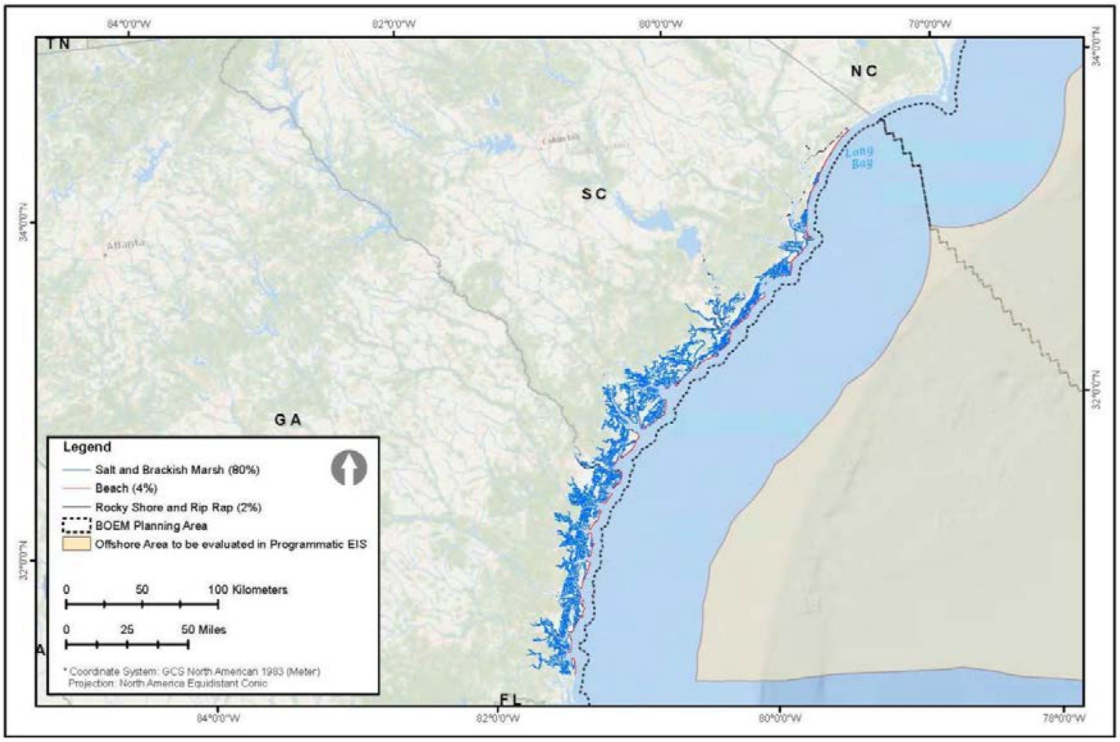


Figure C-27. Coastal and Estuarine Habitats Adjacent to the South Atlantic Planning Area (From: USDOC, NOAA, ORR, 2015).

4.3.2.2. Barrier Islands

Many barrier islands exist along the South Atlantic Coast (**Figure C-27**; **Table C-9**).

Barrier islands in northern South Carolina are composed of unconsolidated sands, while those in southern South Carolina and Georgia consist of younger, sandy components on the eastern sides, and older, stratigraphically variable deposits on the western sides (Pennings et al., 2012).

The outer coast of South Carolina has 18 sandy barrier islands (**Table C-27**; **Figure C-9**). These islands formed under a complex, high energy environment, and have topographic features resulting from cyclical advance and retreat of shorelines with sea level change. The shapes of these islands are influenced by the interaction of wind, waves, storms, and tides (Riekerk, 2000). The northern islands have a narrower, linear shape, while the southern islands are wider and comparatively short.

Table C-9. Barrier Islands Adjacent to the South Atlantic Planning Area.

State	Number of Barrier Islands	Barrier Island Names	Accessible by Roadway	Accessible by Boat
South Carolina	18	Cape Romain, Bull, Capers, Dewees, Isle of Palms, Sullivans, Morris, Folly Beach, Kiawah, Seabrook, Eddingsville, Edisto, Hunting, Fripp, Pritchards, Hilton Head, Daufuskie, and Turtle Islands	Isle of Palms, Sullivans, Kiawah, Folly Beach and others	Daufuskie, Bulls, Cape Romain, Capers, Dewees, Morris, and others
Georgia	8	Cumberland/Little Cumberland, Jekyll, St. Simons/Sea Island/Little St. Simons, Sapelo/Blackbeard, St. Catherines, Ossabaw, Wassaw, and Tybee/Little Tybee	Tybee Island, St. Simons/Sea Island and Jekyll Island	Remaining islands (undeveloped; Henry, 2014)

There are a cluster of eight barrier islands off the coast of Georgia (**Table C-9**; **Figure C-27**). Because tidal currents generally run perpendicular to the coast, Georgia's barrier islands are short and wide, separated by relatively deep tidal inlets or sounds. These islands are more stable than North Carolina's long, narrow barrier islands, and have more developed maritime forests. According to Georgia Department of Natural Resources (DNR), a barrier island in Georgia typically includes a wide beach facing the open ocean, with slightly elevated dunes above the high tide line. Behind and protected by the dunes is a maritime forest (Keyes, 2004). Between the barrier island and the mainland, vast expanses of salt marshes typically occur interspersed with some hammock forests.

4.3.2.3. Beaches

Beaches are prevalent along the southern U.S. coast, occurring along the mainland and on barrier islands. In South Carolina and Georgia, 4 percent of the shoreline comprises sand or gravel beaches (**Figure C-27**). Various grasses and plants are found on beach and dune areas. These provide shade, cover, food, and nesting habitat for animals. Beaches also provide habitat for shellfish and other burrowing organisms. Loggerhead turtles nest on some beaches in South Carolina and Georgia.

4.3.2.4. Tidal Flats

Tidal flats occur sporadically along the southern U.S. coast. Muddy or sandy tidal flats occur in this region. These dynamic coastal features change with shifting patterns of sediment deposition and erosion. Tidal flat characteristics are summarized in **Table C-7**.

4.3.2.5. Rocky Shores

There are relatively few rocky shore habitats or armored shorelines along the southern U.S. coast. In South Carolina and Georgia, 2 percent of the shoreline is mapped as rocky shore (**Figure C-27**). Rocky shores provide substrate for encrusting organisms and marine algae, cover for small marine animals, and feeding areas for fish, birds, and other wildlife.

4.3.2.6. Tidal Rivers

The southern U.S. coast contains multiple tidal rivers, tidal streams, and estuaries. The major estuarine areas and tidal rivers along the coastlines of South Carolina and Georgia include the manmade Atlantic Intracoastal Waterway, Waccamaw River, Santee River, Cape Romain area, Wandoo River, Cooper River, Ashley River, Edisto River, St. Helena Sound area, Savannah River, and the St. Mary's River (**Figure C-28**). The same processes described in **Section 4.3.1.6** apply to tidal rivers of this area, and these estuaries similarly provide important nursery and habitat areas for a variety of fish, shellfish, birds and other wildlife.

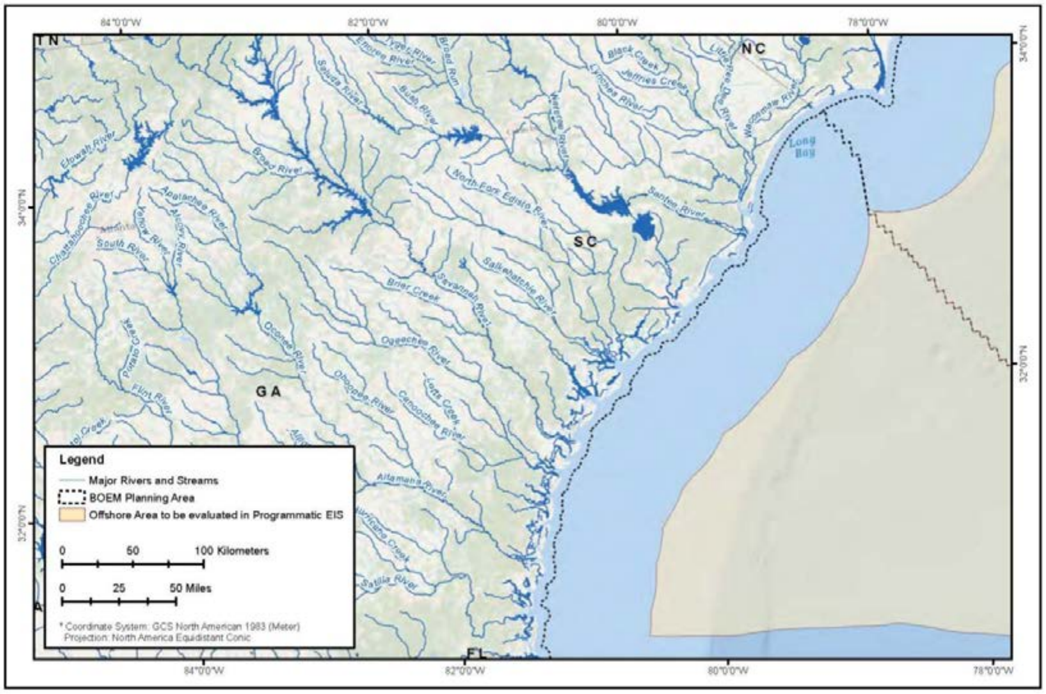


Figure C-28. Major River Systems Adjacent to the South Atlantic Planning Area.

4.3.2.7. Wetlands and Marshes

Wetland habitats evaluated here are limited to salt and brackish water marshes on the southern U.S. coast adjacent to the South Atlantic Planning Area. Freshwater and forested wetlands also occur in this region, but these are located outside of the area evaluated in this Programmatic EIS and therefore they are not described.

According to USEPA (2012a), the coast adjacent to the South Atlantic Planning Area has the highest wetland density of the entire U.S. Atlantic coast. In addition, although Georgia has the shortest coastline of eastern U.S. states, it contains over one-third of its marshland (USEPA, 2012a; Keyes, 2004). In South Carolina and Georgia, 80 percent of the shoreline is mapped as salt and brackish water wetlands and marshes (**Figure C-27**). Saltwater marshes in this area occur on protected shorelines and on the edge of estuaries, including the area between barrier islands and the mainland. Brackish to freshwater marshes extend inland along estuaries where rivers meet the ocean.

In this region, salt marsh vegetation is dominated by smooth cordgrass which occurs at low to medium elevations. Pickleweed (*Salicornia virginica)* or other species may be mixed with the cordgrass at intermediate elevations. Saltgrass is also reported in the intermediate elevations (Henry, 2014). High marsh areas are dominated by black needlerush and bushy seaside tansy (*Borrichia frutescens)*, also called ox-eye (Pennings et al., 2012).

Salt and brackish water marshes are among the most productive ecosystems on the planet, producing considerable amounts of biomass annually (Keyes, 2004), and they serve a variety of important functions (**Table C-8**) (USEPA, 2012).

4.3.2.8. Submerged Aquatic Vegetation

Seagrasses are reported to occur along the entire Atlantic coast of the U.S. with the exception of South Carolina and Georgia. According to Deaton et al. (2010), the high freshwater input, high turbidity, and large tidal amplitude prohibit the growth of seagrass in this region. Marine Cadastre National Viewer maps confirm no seagrass along the coastlines of South Carolina and Georgia.

5.0. MARINE MAMMALS

All marine mammals are protected in U.S. waters under the Marine Mammal Protection Act of 1972 (MMPA; 16 USC 1631 *et seq*.). The MMPA organizes marine mammals into separate stocks for management purposes. By definition, a stock is a group of animals in common spatial arrangement that interbreed (USDOC, NMFS, 2015a). Some species receive additional protection under the ESA (16 USC 1531 *et seq*.). Under the ESA, a species is considered endangered if it is "in danger of extinction throughout all or a significant portion of its range." A species is considered threatened if it "is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range."

In the Atlantic, northern Gulf of Mexico, and Arctic OCS regions, NMFS is the federal agency responsible for conservation and management of whales, seals, dolphins, and porpoises. The USFWS manages manatees in the Gulf of Mexico and Atlantic, and in Alaskan waters, the USFWS manages sea otters, walruses, and polar bears. The MMPA also created the U.S. Marine Mammal Commission to provide an oversight role for the federal agencies implementing the MMPA.

5.1. ALASKA PROGRAM AREA

This section provides a regional summary description of marine and terrestrial mammals in the Alaska Program Area (Figure 2.1-1 of the Programmatic EIS).

5.1.1. Marine Mammals

Figure C-29 demonstrates biologically important areas (BIAs) for some of the mammalian species found in Alaskan waters in reference to the Alaskan Planning and Presidential Withdrawal Areas.

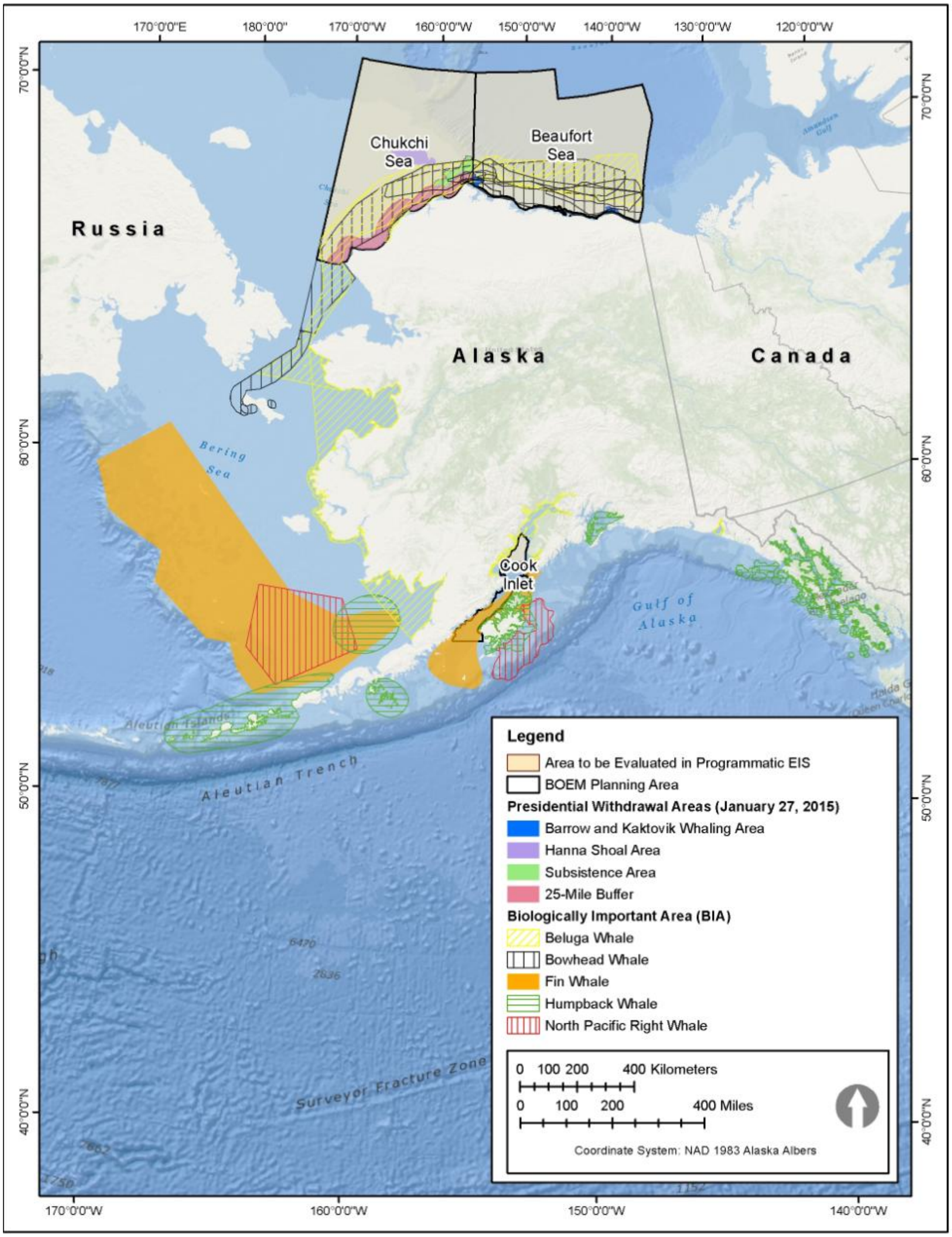


Figure C-29. Biologically Important Areas for Some of the Listed Species Found in Waters Offshore Alaska in Reference to BOEM Planning Area and 2015 Presidential Withdrawal Areas.

5.1.1 Beaufort Sea and Chukchi Sea Planning Areas

5.1.1.1. Listed under the Endangered Species Act

There are seven species of marine mammals in the Beaufort and Chukchi Seas that are listed under the ESA. These seven species include three mysticetes, three pinnipeds, and one fissiped.

Bowhead whale (*Balaena mysticetus*)

The bowhead whale occurs in seasonally ice-covered waters of the Arctic and near Arctic, typically between 60° and 75° N in the western Arctic Basin (Allen and Angliss, 2013). The Western Arctic Stock is the only bowhead stock in U.S. waters (Allen and Angliss, 2013). Bowhead whales generally migrate in November to March from winter breeding areas in the northern Bering Sea, through the Chukchi Sea in the spring, between March and June, where most calving occurs. They move into the Canadian Beaufort Sea where they spend much of the summer, between mid-May and September (Allen and Angliss, 2013).

Incorporation of recent scientific and traditional knowledge has provided updated information on movements and behavior of the Western Arctic Stock. During July and August of 2012 and 2013, aerial surveys were conducted in the western Beaufort Sea with relatively high sighting rates of bowhead whales (Clarke et al., 2014). Quakenbush et al. (2010a) noted that during fall, the area near Barrow and the northern half of Lease Sale Area 193 in the Chukchi Sea received a lot of use by bowheads; whereas the eastern Chukchi Sea, especially nearshore from Wainwright to the Bering Sea, was not used as often. Clarke et al. (2014) sighted bowheads in every month except October in the northeastern Chukchi Sea. In the spring, bowheads have been observed calving, mating, and feeding in the nearshore lead near Wainwright and Barrow (Huntington and Quakenbush, 2009; Quakenbush and Huntington, 2010). The best estimate of the abundance of the Western Arctic Stock is 16,892, with a minimum population estimate of 13,796 (Allen and Angliss, 2014).

Fin Whale (*Balaenoptera physalus*)

The fin whale (*Balaenoptera physalus*) ranges from subtropical to Arctic waters and usually occurs in high-relief areas where productivity is probably high (Brueggeman et al., 1988); it consists of one stock, the Northeast Pacific Stock. Their summer distribution extends from central California into the Chukchi Sea, while their winter range is restricted to the waters off the coast of California. In Alaskan waters, some fin whales feed throughout the Bering and Chukchi Seas from June through October. Observations of fin whales have been increasing in the eastern half of the Chukchi Sea in the summer (Allen and Angliss, 2013) with three being observed in 2013 (Clarke et al., 2014).

Fin whales usually breed and calve in the warmer waters of their winter range (Mizrock et al., 1984). Reliable abundance estimates for the Northeast Pacific Stock are not available. A provisional estimate for the fin whale population west of the Kenai Peninsula is 1,368 (Allen and Angliss, 2014); it is possible that whales were counted twice when previous estimates were summed. The estimate also is considered a minimum estimate for the entire stock since it was made based on surveys that covered a small portion of the stock (Allen and Angliss, 2014).

Humpback Whale (*Megaptera novaeangliae*)

The humpback whale (*Megaptera novaeangliae*) occurs worldwide in all ocean basins, although it is less common in Arctic waters. NMFS recognizes three stocks of humpback whales in U.S. waters, including the (1) California/Oregon/Washington Stock; (2) Central North Pacific Stock; and (3) the Western North Pacific Stock. Humpback whales in the North Pacific are seasonal migrants to Arctic waters where they feed on zooplankton and small schooling fishes in the cool coastal waters of the western U.S., western Canada, and the Russian Far East (USDOC, NMFS, 1991). The historic feeding range of humpback whales in the North Pacific encompassed coastal and inland waters around the Pacific Rim from Point Conception, California, north to the Gulf of Alaska and the Bering Sea, and west along the Aleutian Islands to the Kamchatka Peninsula and into the Sea of Okhotsk (Johnson and Wolman 1984; Allen and Angliss, 2013). Some individuals were observed in the Beaufort Sea east of Barrow, suggesting a northward expansion of their feeding grounds (Zimmerman and Karpovich, 2008; Allen and Angliss, 2014). Current data suggest the Bering Sea remains an important feeding area.

During summer months, humpback whales also will enter the Chukchi Sea, with rare observations in the western Beaufort Sea (Johnson and Wolman, 1984; Hashagen et al., 2009; Allen and Angliss, 2013). Currently, it is unclear whether humpbacks observed in the southeastern Chukchi Sea and in the Beaufort Sea are part of the Western or Central Stock. Clarke et al. (2014) reported sightings of four humpback whales in the northeastern Chukchi Sea, and 29 whales in 2012 (Clark et al., 2013). The Western North Pacific Stock spends winter and spring in waters off Japan and migrates to the Bering Sea, Chukchi Sea, and Aleutian Islands in the summer and fall (Berzin and Rovnin, 1966; Allen and Angliss, 2011). The Central North Pacific Stock winters in Hawaiian Island waters and migrates in the summer and fall to northern British Columbia/southeast Alaska, and to Prince William Sound west to Kodiak Island (Baker et al., 1990; Allen and Angliss, 2014). The minimum population estimate for the Western North Pacific Stock is approximately 865 individuals, while that for the Central North Pacific Stock is approximately 7,890 individuals (Allen and Angliss, 2014).

Bearded Seal (*Erignathus barbatus*)

As of December 2012, the bearded seal was listed as threatened (77 FR 76740), but this designation was removed on July 25, 2014 (Alaska Oil and Gas Association v. Pritzker, 13-18-RRB, D. Alaska). The bearded seal occurs throughout the Arctic, usually inhabiting waters <200 m (660 ft) deep in areas of broken, moving sea ice (Cleator and Stirling, 1990; Allen and Angliss, 2011). Most of the bearded seals in Alaska occur over the continental shelf of the Bering, Chukchi, and Beaufort Seas between 57° and 85° N (Cameron and Boveng, 2009). During spring, bearded seals prefer areas that contain 70 to 90 percent sea ice coverage and are most abundant 32 to 161 km (20 to 100 mi) from shore, except for the nearshore concentration to the south of Kivalina (Allen and Angliss, 2013). Bearded seals generally prefer ice habitat that is in constant motion and produces natural openings and areas of open water such as leads, fractures, and polynyas for breathing, hauling out on the ice, and access to water for foraging. They usually avoid areas of continuous, thick, shorefast ice and rarely occur in the vicinity of unbroken, heavy, drifting ice or large areas of multi-year ice (Cameron et al., 2010).

Pupping takes place on top of the ice <1 m (3 ft) from open water (Kovacs et al., 1996) from late March through May mainly in the Bering and Chukchi Seas, although some pupping occurs in the Beaufort Sea. Bearded seals tend to be solitary (Nelson, 2008a), but sometimes form loose aggregations in polynya systems. Bearded seals primarily feed on benthic prey such as crustaceans, mollusks, fishes, and octopuses (USDOC, NMFS, 2011a). In the 1970s, the estimated number of bearded seals in the Bering and Chukchi Seas was 250,000 to 300,000 (Nelson, 2008a). Allen and Angliss (2014) stated that there are no current population estimates or trends for the Alaska Stock of the bearded seal; however, preliminary results from a current study yield an estimate of 299,174 in the Bering Sea. An older study reported 27,000 in the Chukchi Sea (Allen and Angliss, 2014). Beaufort Sea bearded seal population estimates are unknown (Laidre et al., 2015; Allen and Angliss, 2014).

Ringed Seal (*Phoca hispida hispida*)

Since December 2012, Alaska's stock of the ringed seal (*Phoca hispida hispida*) has been listed as threatened (77 FR 767060). The ringed seal is circumpolar in distribution and is associated with ice for much or all of the year. It occurs throughout the Beaufort, Chukchi, and Bering Seas as far south as Bristol Bay (Allen and Angliss, 2013). The ringed seal is the most abundant seal in the Arctic (Citta, 2008). Ringed seals live on and under extensive, largely unbroken, shorefast ice, preferring water depths of 10 to 20 m (33 to 66 ft) (ADNR, 2009), however some ringed seals maintain subnivian lairs and breathing holes under solid sea ice over deeper waters. Ice cover strongly influences ringed seal movements, foraging, reproductive behavior, and vulnerability to predation (Kelly et al., 2010b). In the winter/spring period, when ringed seals occupy shorefast ice, their home ranges extend from <1 to 27.9 km^2 (0.4 to 10.8 mi^2). Ringed seals inhabiting shorefast ice in the Beaufort Sea occupy ranges averaging <2 km^2 (0.8 mi^2) from April through early June (Kelly et al., 2010a). In summer/ and fall, ringed seals may range up to 1,800 km (1,120 mi) from their winter and spring home ranges, and return to the same home range sites during the ice-bound months the following year. They continue to use sea ice as resting platforms during the summer through fall period (Kelly et al., 2010a). Some ringed seals occur during ice-free periods in the Bering and Chukchi Seas (Citta, 2008).

When sexually mature, males establish territories during the fall and maintain them during the pupping season. During the breeding and pupping season, adults on shorefast ice (floating fast-ice zones) usually move less than individuals in other habitats; they depend on a relatively small number of holes and cracks in the ice for breathing and foraging. They are capable of diving to depths >500 m (1,640 ft) and dives can last up to 39 minutes (Born et al., 2004). In the winter and spring, ringed seals feed under the ice, while in summer and fall they feed either in open water or under the ice (Kelly et al. 2010a). Ringed seals' preferred prey includes Arctic cod, herring, shrimps, and mysids (USDOC, NMFS, 2011a). A reliable population estimate and minimum population estimate for the Alaskan Stock are not available, but preliminary results from a current study gives an abundance estimate of 170,000 (Allen and Angliss, 2014). Critical habitat for the ringed seal was proposed by NMFS in the northern Bering, Chukchi, and Beaufort Seas in December 2014. This area extends to the outer boundary of the EEZ in the Beaufort and Chukchi Seas and south into the Bering Sea, as far south as Bristol Bay (79 FR 71714).

Pacific Walrus (*Odobenus rosmarus divergens*)

The Pacific walrus (*Odobenus rosmarus divergens*), a candidate for ESA listing (USDOI, USFWS, 2015a; 79 FR 72449), ranges throughout the shallow continental shelf waters of the Bering and Chukchi Seas, where its distribution is linked closely with the seasonal distribution of the pack ice. It occasionally moves into the eastern Siberian Sea and western Beaufort Sea during summer (Fay, 1982). The Pacific walrus is an extremely social and gregarious animal that spends approximately one-third of its time hauled out onto land or ice, usually in close physical contact with others. Group size can range from several individuals to several thousand individuals (USDOI, USFWS, 2011a). The Pacific walrus relies on sea ice as a substrate for resting, giving birth and nursing, isolation from predators, and passive transport to new feeding areas (USDOI, USFWS, 2009d). Spring migration usually begins in April, and most Pacific walruses move north through the Bering Strait by late June. During the summer months, most of the population moves into the Chukchi Sea; however, several thousand individuals, primarily adult males, use coastal haulouts in the Bering Sea (USDOI, USFWS, 2014). Two large Arctic areas are occupied by Pacific walruses during summer — from the Bering Strait west to Wrangell Island, and along the northwest coast of Alaska from close to Point Hope to north of Point Barrow. Although a few Pacific walruses may move east throughout the Alaskan portion of the Beaufort Sea to Canadian waters during the open-water season, the majority of the population occurs west of 155° W, north and west of Barrow, with the highest seasonal abundance along the pack-ice front. With the southern advance of the pack ice in the Chukchi Sea during the fall (October to December), most of the Pacific walrus population migrates south of the Bering Strait, although solitary animals may occasionally overwinter in the Beaufort and Chukchi Seas.

USDOI, USFWS (2014) provided estimates of the Pacific walrus population over the past several centuries. A minimum population of 200,000 animals occurred in the 18^{th} and 19^{th} centuries. Commercial harvests reduced the population to an estimated 50,000 to 100,000 by the 1950s. Between 1975 and 1990, the estimated population ranged from 201,039 to 234,020 animals, and the 2006 estimated minimum population was 129,000 animals. In 2012, genetic fingerprinting of individual walruses began, continuing in 2015 to assess the success of the method (USDOI, USFWS, 2015b). Major stressors to the Pacific walrus are subsistence harvest with a total of 969 harvested in 2011 (USDOI, USFWS, 2012), and loss of sea ice (USDOI, USFWS, 2011a).

Polar Bear (*Ursus maritimus*)

The polar bear is federally listed as threatened. It lives only on the Arctic ice cap in the Northern Hemisphere, mainly near coastal areas. The polar bear is considered a marine mammal because it principally inhabits the sea ice surface rather than adjacent land masses (Amstrup, 2003). There are two polar bear stocks recognized in Alaska: the Southern Beaufort Sea Stock and the Bering/ Chukchi Seas Stock. The Southern Beaufort Sea population ranges from the Baillie Islands, Canada, and west to Point Hope, Alaska. Individuals of the Bering/Chukchi Seas Stock range widely on pack ice from Point Barrow, Alaska, west to the eastern Siberian Sea. The stock's southern boundary in the Bering Sea is determined by the annual extent of the pack ice (USDOI, USFWS, 2010). These two stocks overlap between Point Hope and Point Barrow, Alaska, centered near Point Lay (Allen and Angliss, 2013). The USFWS designated critical habitat for the polar bear on December 7, 2010 (USDOI, USFWS, 2010b). However, on January 10, 2013 the U.S. District Court for the District of Alaska issued an order vacating and remanding to the Final Rule, designating the polar bear critical habitat (USDOI, USFWS, 2015c). Currently, there is no critical habitat designated for the polar bear.

Seasonal movements of polar bears reflect changing ice conditions and breeding behavior. In spring, polar bears in the Beaufort Sea overwhelmingly prefer regions with ice concentrations >90 percent and composed of ice floes 2 to 10 km (1.2 to 6.2 mi) in diameter (Durner et al., 2004). Mature males range offshore in early spring, but move closer to shore during the spring breeding season. With the breakup of the ice during spring and early summer, polar bears move northward where they select habitats with a high proportion of old ice. To reach this ice, polar bears may migrate as much as 1,000 km (620 mi) (Amstrup, 2003). As ice reforms in the fall, the bears move southward, and by late fall are distributed seaward of the Chukchi and Beaufort Sea coasts. During winter, polar bears prefer the lead ice system at the shear zone between the shorefast ice and the active offshore ice. The annual activity areas for female polar bears in the Beaufort Sea range from 13,000 to 597,000 km^2 (5,020 to 230,500 mi^2) with an average area of 149,000 km^2 (57,530 mi^2) (Amstrup et al., 2000).

Pregnant and lactating females with newborn cubs are the only polar bears to occupy winter dens for extended periods (Lentfer and Hensel, 1980; Amstrup and Gardner, 1994). The key denning habitat characteristics are topographic features that catch snow for den construction and maintenance (USDOI, USFWS, 2008b). The main terrestrial denning areas for the Southern Beaufort Sea Stock in Alaska occur on the barrier islands from Barrow to Kaktovik and along coastal areas up to 40 km (25 mi) inland (USDOI, USFWS, 2010). Most onshore dens are close to the seacoast, usually not >8 to 10 km (5 to 6 mi) inland. Information on polar bear use of terrestrial habitat for maternity denning in and near the Prudhoe Bay oil field indicates that dens were located or associated with pronounced landscape features such as coastal and river banks, as well as lake shores and abandoned oil field gravel pads (Durner et al., 2003). In the Beaufort Sea and to a limited extent in the Chukchi Sea, females may den on the drifting pack ice (Schliebe et al., 2005). Females enter dens by late November, with young being born in late December or January (Lentfer and Hensel, 1980). Polar bears do not have denning site fidelity, but do return to the general substrate (i.e., land or ice) and geographic area (e.g., eastern or western Beaufort Sea) (ADNR, 2009). Females and cubs emerge from dens in late March or early April. Coastal areas provide important denning habitat for polar bears. More polar bears are now denning near shore, rather than in far offshore regions. Data indicated that approximately 64 percent of all polar bear dens in Alaska from 1997 to 2004 occurred on land, compared to approximately 36 percent of dens from 1985 to 1994 (Fischbach et al., 2007). Recent information indicates that survival rates of cubs-of-the-year are now significantly lower than they were in previous studies, and there has also been a declining trend in cub-of-the-year size for the Southern Beaufort Sea Stock. Although many cubs are currently being born into the Southern Beaufort Sea Stock region, more females are apparently losing their cubs shortly after den emergence, lowering recruitment of new bears into the population (Regehr et al., 2006). Bromaghin et al. (2015) stated that survival of adults and cubs was comparatively stable from 2008 to 2010 but the survival of subadult bears declined throughout the entire period.

Polar bears normally occur at low densities throughout their range. Most of the year, polar bears are solitary or occur in family groups of a mother and her cubs (Lentfer and Small, 2008). Polar bears do aggregate along the Beaufort Sea coastline in the fall in areas where harvesting and butchering of marine mammals occurs. Specific aggregation areas include Point Barrow, Cross Island, and Kaktovik (USDOI, USFWS, 2011j). Polar bear concentrations also occur during the winter in areas of open water such as leads and polynyas, and areas where beach-cast marine mammal carcasses occur (USDOI, USFWS, 2011j).

The predominant prey item of polar bears in Alaska is ringed seals, and to a lesser degree bearded seals (Stirling and McEwan, 1975; Stirling and Archibald, 1977; Stirling and Latour, 1978; USDOI, USFWS, 2015d), and spotted seals. To hunt seals in the Beaufort Sea, polar bears concentrate in shallow waters <300 m (1,000 ft) deep over the continental shelf and in areas with >50 percent ice cover (Allen and Angliss, 2011). In addition, bears may take walruses (Calvert and Stirling, 1990), beluga whales (Freeman, 1973; Heyland and Hay, 1976; Lowry et al., 1987), caribou (Derocher et al., 2000; Brook and Richardson, 2002), and other polar bears (Amstrup et al., 2006; Taylor et al., 1985). Cannibalism of cubs and juvenile bears by adult bears is not uncommon (Dyck and Daley, 2002; Derocher and Wiig, 1999). Polar bears also scavenge whale, seal, and walrus carcasses (USDOI, USFWS, 2008b).

A reliable population estimate for the Chukchi/Bering Seas Stock does not exist, but the best information available provides a minimum population estimate of 2,000 individuals for the stock. There also is no reliable population trend for this stock (USDOI, USFWS, 2010). The best population estimate for the Southern Beaufort Sea Stock is 1,526 individuals with a minimum population abundance of 1,397. This stock is experiencing a population decline due to loss of sea ice, partly due to climate change, and by potential overharvest and human activities, including industrial activities in nearshore and offshore environments (USDOI, USFWS, 2015e).

5.1.1.2. Not Listed under the Endangered Species Act

Of the 15 species of marine mammals in the Arctic region (Beaufort and Chukchi Seas), 8 are not listed under the ESA. The mysticetes account for two of these species while four species are odontocetes. There are also two species of pinnipeds. Information on each species or species group, where appropriate, is provided in **Table C-10**.

5.1.1.3. Unusual Mortality Event in the Arctic

On December 20, 2011, NMFS declared an unusual mortality event (UME) in the Arctic and Bering Strait region of Alaska. From mid-July through December 20, 2011, more than 60 dead and 75 diseased seals (mostly ringed seals) were reported in Alaska (USDOC, NMFS, 2011k). The USFWS also identified diseased and dead walruses at the annual mass haul out at Point Lay (USDOC, NMFS 2011k). Symptoms of the disease included skin sores (usually on the hind flippers or face), and patchy hair loss. Similar symptoms have been observed in ringed seals and walruses in Russia and ringed seals in Canada (USDOC, NMFS, 2011k). Necropsies have revealed fluid in the lungs, white spots on the liver, and abnormal growths in the brain.

A single cause of the disease is still not known, but tests are ongoing for radionuclide exposure, vitamins, hormones, cyanotoxins and a number of bacteria and viruses (USDOC, NMFS, 2013, 2014). Only three new cases of the disease were found in the Pacific walrus from field studies in 2012 through 2013 (USDOC, NMFS, 2014). Therefore, the walrus was removed from the UME in the spring of 2014.

On April 6, 2012, the USGS (2012) reported that nine polar bears in the southern Beaufort Sea region near Barrow had been observed with alopecia (loss of fur) and skin lesions. The cause of these symptoms, and whether they are related to similar symptoms for seals and walruses, is unknown at this time.

Table C-10. Information on Non-Listed Marine Mammal Species Occurring in the Arctic.

Non-Listed Species	Distribution	Abundance Estimate	Abundance Estimate Minimum	Last Survey
Gray whale (*Eschrichtius robustus*)	• Occurs in the Gulf of Alaska in late March and April and consists of the Eastern North Pacific Stock • Moves into the Northern Bering Sea in May or June and then enters the Beaufort and Chukchi Seas in July or August (Rice and Wolman, 1971; Consiglieri et al., 1982; Frost and Karpovich, 2008)	19,126	18,017	2007
Minke whale (*Balaenoptera acutorostrata*)	• Occurs from the Bering and Chukchi Seas south to near the equator with apparent concentrations near Kodiak Island (Leatherwood et al., 1982; Rice and Wolman, 1982) • Sightings are infrequent during the summer months in the Chukchi	N/A	N/A	N/A
Beluga whale (*Delphinapterus leucas*)	• Subarctic and Arctic species • Consists of the Beaufort Sea and Eastern Chukchi Sea Stocks • Occurs in coastal waters in summer and fall	E. Chukchi: 3,710 Beaufort Sea: 39,258	E. Chukchi: N/A Beaufort Sea: 32,453	E. Chukchi: 1991 Beaufort Sea: 2000
Harbor porpoise (*Phocoena phocoena*)	• Occurs from Point Barrow along the Alaskan coast to Point Conception, California (Allen and Angliss, 2014) • Part of the Bering Sea Stock that occurs throughout the Aleutian Islands, and all waters north of Unimak Pass (Angliss and Allen, 2013)	48,215	40,039	1999
Killer whale (*Orcinus orca*)	• Occurs along the entire Alaskan coast within the Chukchi Sea, Bering Sea, Aleutian Islands, Gulf of Alaska, Prince William Sound, Kenai Fjords, and southeast Alaska • Consists of Eastern North Pacific Northern Resident Stock • Some may stay in the western part of the Beaufort Sea (Culik, 2010)	2,347 / 587	2,347 / 587	2012/ 2012
Ribbon seal (*Phoca fasciata*)	• Occurs in the open sea, on pack ice, and rarely on shorefast ice (Allen and Angliss, 2011) • Ranges northward from Bristol Bay in the Bering Sea to the Chukchi and western Beaufort Seas (Allen and Angliss, 2013) • Reliable abundance estimate not available	61,100 (provisional)	N/A	2012
Spotted seal (*Phoca largha*)	• Bering Sea Distinct Population Segment • Occurs along the continental shelf of the Beaufort, Chukchi, and Bering Seas (Allen and Angliss, 2013) • Occurs year-round in the Bering Sea but only in the summer in the Beaufort and Chukchi Seas (Nelson, 2008c)	460,268	391,000	2012

Abundance data from Allen and Angliss (2014), except for the gray whale. Gray whale abundance data from Allen and Angliss (2011).
N/A = not available.

5.1.2. Cook Inlet Planning Area

5.1.2.1. Listed under the Endangered Species Act

There are nine marine mammal species that may occur in the Cook Inlet Planning Area that are classified as endangered or threatened under the ESA: five mysticetes, two odontocetes, one pinniped, and one fissiped.

North Pacific Right Whale (*Eubalaena japonica*)

The North Pacific right whale (*Eubalaena japonica)* remains the most highly endangered marine mammal in the world. Little is known regarding the migratory behavior, life history characteristics, and habitat requirements of this species. The North Pacific right whale historically ranged across the entire North Pacific north of 35° N and occasionally as far south as 20° N before commercial whaling reduced their numbers. Today, distribution and migratory patterns of the North Pacific Stock are largely unknown. The minimum abundance estimate, made through photo-identification, is 20 individuals and through genetic identification, 23 individuals (Allen and Angliss, 2014). The whales in the North Pacific population summer in their high-latitude calanoid copepod and euphausiid crustacean feeding grounds, and migrate to more temperate, possibly offshore, waters during the winter (Braham and Rice, 1984; Scarff, 1986; Allen and Angliss, 2013).

There is evidence of North Pacific right whale occurrence in the Gulf of Alaska and the Bering Sea (Wade et al., 2011). Right whales remain in the southeastern Bering Sea from May through December (Allen and Angliss, 2014). Recent sightings have been concentrated in the western outer Bristol Bay area, midway between Unimak Island and Kuskokwim Bay, and this area may be an important feeding area for the few remaining North Pacific right whales (Shelden et al., 2005). More recent sightings of North Pacific right whales in the eastern Bering Sea during the summer are the first reliable observations in decades (Moore et al., 2000b; Tynan et al., 2001; Wade et al., 2011). These sightings suggest the abundance of the eastern North Pacific right whale is possibly in the tens of animals. NMFS revised the species' critical habitat on July 6, 2006 (71 FR 38277) to include one area in the Gulf of Alaska and one in the Bering Sea, and changed the designated critical habitat (**Figure C-30**) for the North Pacific right whale in April 2008 (73 FR 19000).

Blue Whale (*Balaenoptera musculus*)

The blue whale (*Balaenoptera musculus*) primarily occurs south of the Aleutian Islands and the Bering Sea (Berzin and Rovnin, 1966; USDOC, NMFS, 2011a). It also occurs north of 50° N, extending from southeastern Kodiak Island across the Gulf of Alaska and from southeast Alaska to Vancouver Island (Berzin and Rovnin, 1966). Blue whales from the Eastern North Pacific Stock and Western North Pacific Stock can occur in the Gulf of Alaska during spring and summer, after wintering in subtropical and tropical waters (Carretta et al., 2013). The Eastern North Pacific Stock occurs in the eastern North Pacific, ranging from the northern Gulf of Alaska to the eastern tropical Pacific. Blue whales from the Central North Pacific Stock feed in summer southwest of Kamchatka, south of the Aleutian Islands, and in the Gulf of Alaska.

While the blue whale occurs in south-central Alaska, it is not expected to occur within Cook Inlet. Blue whales tend to occur alone or in pairs, but aggregations of 12 or more may develop in prime feeding grounds (Jefferson et al., 2006). Blue whales feed year-round (Carretta et al., 2011) on krill (euphausiids) (Pauly et al., 1995; Jefferson et al., 2006; USDOC, NMFS, 2011a). The best estimate of the abundance of the Eastern North Pacific Stock is 1,647, with a minimum abundance of 1,551 (Caretta et al., 2014). The best available abundance estimate for the Central North Pacific Stock is 81, with a minimum of 38 (Caretta et al., 2014).

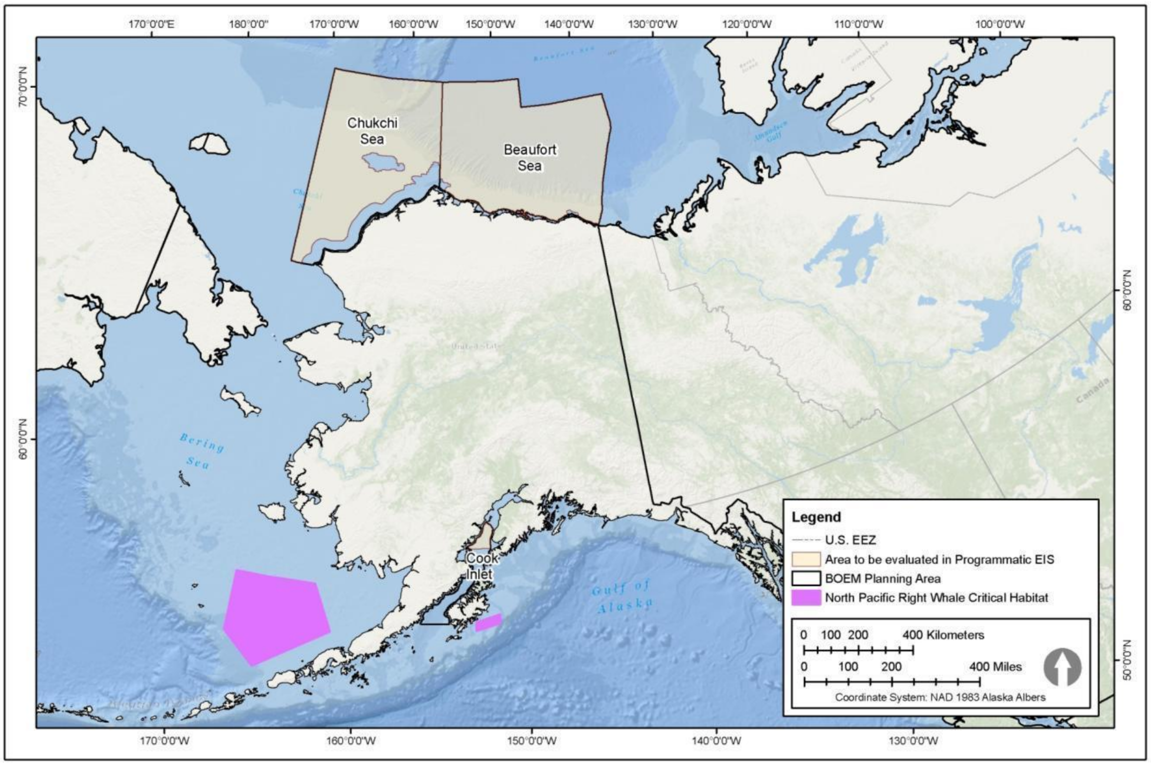


Figure C-30. Critial Habitat for the North Pacific Right Whale

Fin Whale (*Balaenoptera physalus*)

The fin whale ranges worldwide from subtropical to Arctic waters, and most sightings occur where deep water approaches the coast (Jefferson et al., 2006). Most fin whales migrate seasonally from relatively low-latitude wintering habitats where breeding and calving occur, to high-latitude summer feeding areas (Perry et al., 1999). Northward migration begins in spring with migrating whales entering the Gulf of Alaska from early April through June (USDOI, MMS, 1996b). Some fin whales feed in the Gulf of Alaska, including near the entrance to Cook Inlet (USDOC, NMFS, 2003), and during the months of July and August they are concentrated in the Bering Sea-eastern Aleutian Island area. From September to October, most fin whales are in the Bering Sea, Gulf of Alaska, and along the U.S. coast as far south as Baja, California (Mizroch et al., 1984; Brueggman et al., 1984). A provisional estimate for the fin whale population west of the Kenai Peninsula is 1,368 animals (Allen and Angliss, 2014). This is provisional due to the possibility of whales being double-counted when previous estimates were summed.

Sei Whale (*Balaenoptera borealis*)

The sei whale (*Balaenoptera borealis*) is an oceanic species that occurs in tropical to polar waters, but is more common in mid-latitude temperate zones. It seldom occurs close to shore (Jefferson et al., 2006) and inhabits deepwater areas of the open ocean, most commonly over the continental slope (Carretta et al., 2011; Reeves et al., 1998). Sei whales migrate to lower latitudes for breeding and calving in the winter and to higher latitudes in summer for feeding, including the Gulf of Alaska and along the Aleutian Islands and the southern Bering Sea (Reeves et al., 1998). Groups of 2 to 5 individuals are commonly observed, but loose aggregations of 30 to 50 occasionally do occur (Jefferson et al., 2006; USDOC, NMFS, 2015h). Sei whales observed in Alaska are members of the Eastern North Pacific Stock and/or the Hawaiian Stock. The abundance of the Eastern North Pacific Stock is estimated at 126 individuals with a minimum estimate of 83 whales (Caretta et al., 2014); while abundance estimates for the Hawaiian Stock are 178 with a minimum abundance of 93 (Caretta et al., 2014; Allen and Angliss, 2014).

Humpback Whale (*Megaptera novaeangliae*)

Members of the Western North Pacific and Central North Pacific Stocks of humpback whalesoccur in Alaskan waters. In the Gulf of Alaska, areas with concentrations of humpback whales include the Portlock and Albatross Banks, and west to the eastern Aleutian Islands, Prince William Sound, and the inland waters of southeastern Alaska (Berzin and Rovnin, 1966). Humpback whales also have been observed routinely in lower Cook Inlet (Rugh et al., 2005, 2007). The Kodiak Island area supports a feeding aggregation of humpback whales (Waite et al., 1999). Current data demonstrate that the Bering Sea remains an important feeding area.

Humpback whales usually occur alone or in groups of two or three, although larger aggregations occur in breeding and feeding areas (Jefferson et al., 2006). The best population estimate for the Western North Pacific Stock is 1,107 whales, with a minimum population estimate of 865 individuals; the best population estimate for the Central North Pacific Stock is 10,103 whales, with a minimum population estimate of 7,890 individuals (Allen and Angliss, 2014).

Sperm Whale (*Physeter macrocephalus*)

The sperm whale (*Physeter macrocephalus*) occurs worldwide in deep waters from the tropics to the pack-ice edges, although generally only large males venture to the extreme northern and southern portions of the range (Jefferson et al., 2006). In Alaska, their northernmost boundary extends from Cape Navarin (62° N) to the Pribilof Islands, with whales more commonly found in the Gulf of Alaska and along the Aleutian Islands. The shallow continental shelf may prevent their movement into the northeastern Bering Sea and Arctic Ocean (Allen and Angliss, 2014). Females and young sperm whales usually remain in tropical and temperate waters year-round, while males move north to feed in the Gulf of Alaska, Bering Sea, and waters around the Aleutian Islands (Gosho et al., 1984; Allen and Angliss, 2013). Seasonal movement of sperm whales in the North Pacific is not well-defined, but they typically occur south of 40° N during the winter (Gosho et al., 1984). Fall migrations begin in September and most whales have left Alaskan waters by December (USDOI, MMS, 1996b), returning to temperate and tropical portions of their range, typically south of 40° N, in the fall (Gosho et al., 1984; Allen and Angliss, 2013). Sperm whales are present year-round in the Gulf of Alaska, but are apparently more abundant in summer than in winter (Allen and Angliss, 2013). The number of sperm whales occurring in Alaska waters is unknown. More than 100,000 sperm whales were estimated in the western North Pacific in the late 1990s (Allen and Angliss, 2013).

Beluga Whale (*Delphinapterus leucas*)

NMFS recognizes five stocks of beluga whales in U.S. waters: (1) Cook Inlet, (2) Bristol Bay, (3) eastern Bering Sea, (4) eastern Chukchi Sea, and (5) Beaufort Sea (Allen and Angliss, 2013). There are few physical barriers among these stocks, but genetic data indicate that the stocks do not interbreed (Citta and Lowry, 2008). Most of the Cook Inlet Stock was listed as an endangered distinct population segment (DPS) under the ESA in 2008 (USDOC, NMFS, 2008a). Fewer than 20 beluga whales inhabit Yakutat Bay; these are included as part of the Cook Inlet Stock but are not considered part of the Cook Inlet DPS (Allen and Angliss, 2013).

The beluga whale occurs throughout seasonally ice-covered Arctic and subarctic waters of the Northern Hemisphere (Stewart and Stewart, 1989), and is closely associated with open leads and polynyas in ice-covered regions (Allen and Angliss, 2013). Depending on season and region, beluga whales may occur in both offshore and coastal waters. Ice cover, tidal conditions, access to prey, temperature, and human interaction affect seasonal distribution (Allen and Angliss, 2014). During the winter, beluga whales generally occur in offshore waters associated with ice packs, and in the spring, many migrate to warmer coastal estuaries, bays, and rivers for molting and calving (Sergeant and Brodie, 1969). Breeding occurs in March or April, with calves born the following May through July, usually when herds are at or near summer concentration areas (Citta and Lowry, 2008). Beluga whales shed their skin (molt) yearly in July in shallow water, often where there is coarse gravel to rub against (Citta and Lowry, 2008).

The Cook Inlet DPS occurs near river mouths in the northern Cook Inlet during the spring and summer months and in mid-Inlet waters in the winter; evidence indicates that the stock remains in Cook Inlet throughout the year (Allen and Angliss, 2014; USDOC, NMFS, 2008a). Based on surveys conducted in the Gulf of Alaska between 1936 and 2000, a few belugas occur in the Gulf of Alaska outside of Cook Inlet. Those belugas are considered part of the Cook Inlet Stock (Laidre et al., 2000).

NMFS (2011b) designated 7,800 km^2 (3,013 mi^2) of critical habitat for the Cook Inlet DPS of beluga whales on April 11, 2011 (**Figure C-31**). Critical Habitat Area 1 and Critical Habitat Area 2 are respectively equivalent to the Type 1 and 2 habitats identified in the conservation plan for the Cook Inlet beluga whale (USDOC, NMFS, 2008b). Critical Habitat Area 1, encompassing 1,909 km^2 (738 mi^2), occurs in the upper portion of Cook Inlet that contains a number of shallow tidal flats, river mouths, and estuarine areas important for foraging, calving, molting, and escaping predators. This area, considered the most valuable for the habitat types it affords Cook Inlet belugas, contains the highest concentrations of belugas from spring through fall (USDOC, NMFS, 2008b, 2011b). Critical Habitat Area 2, encompassing 5,891 km^2 (2,275 mi^2), is used less during spring and fall, but is known to be used in fall and winter. Dispersed fall and winter feeding and transit areas occur in Critical Habitat Area 2, which includes near and offshore areas of the mid- and upper inlet and nearshore areas of the lower inlet. The deeper dives made by Cook Inlet beluga whales suggest this is an important fall and winter feeding area and may be important to the winter survival and recovery of Cook Inlet beluga whales (USDOC, NMFS, 2008b, 2011b).

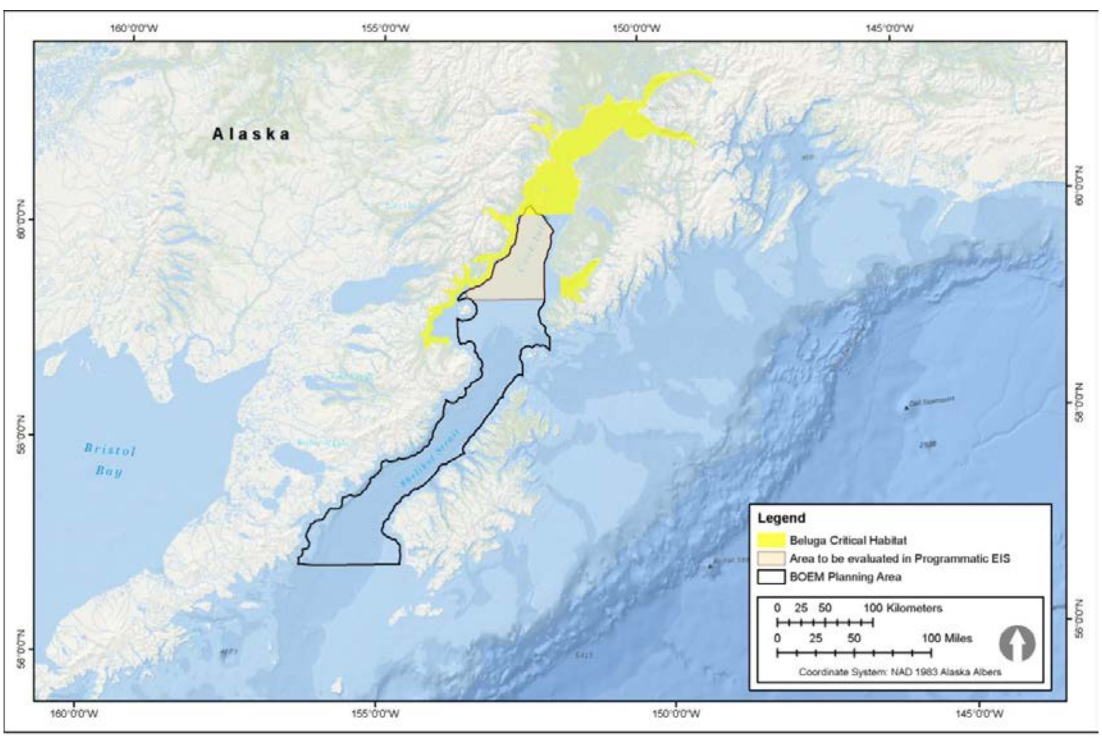


Figure C-31. Beluga Whale Critical Habitat.

During 1978 to 1979, 95 percent of the Cook Inlet beluga whale range occupied 7,226 km^2 (2,790 mi^2) of Cook Inlet (Rugh et al., 2010). The Cook Inlet Stock (which includes the Cook Inlet DPS) was estimated at 1,300 animals in 1979 (USDOC, NMFS, 2008a). By 1994, the stock numbered 653 whales and declined to 347 whales by 1998. Subsistence hunting and interactions with fishing gear appear to have been the major factors leading to declines in abundance (Laidre et al., 2000). The Cook Inlet Stock has continued to decline by 1.45 percent per year from 1999 to 2008 (Allen and Angliss, 2011). Between 1998 and 2008, 95 percent of the beluga whale range in Cook Inlet was 2,806 km^2 (1,083 mi^2). Most areas occupied are in the upper portions of Cook Inlet (Rugh et al., 2010). The best population estimate for the Cook Inlet DPS, from 2012, is 312, with a minimum population estimate of 280 (Hobbs et al., 2012; Allen and Angliss, 2014). A healthy population level for the Cook Inlet beluga whale stock should be at least 780 individuals (USDOC, NMFS, 2008b).

Steller Sea Lion (*Eumetopias jubatus*)

The Steller sea lion (*Eumetopias jubatus*) in Alaska comprises an eastern U.S. stock, which includes animals east of Cape Suckling, Alaska (144° W), and a western U.S. stock, including animals at and west of Cape Suckling (Allen and Angliss, 2013), having centers of abundance in the Gulf of Alaska and Aleutian Islands. The Eastern Stock encompasses the range of the Eastern DPS of the Steller sea lion that was delisted as threatened (78 FR 66139), while the Western Stock encompasses the range of the Western DPS that is listed as endangered under the ESA (USDOC, NOAA, 2011a). Only individuals from the Western Stock inhabit areas of south-central Alaska that could be affected by oil and gas activities in the Cook Inlet Planning Area.

The Steller sea lion is not known to migrate, but individuals disperse widely outside of the breeding season from late May to early July. At sea, Steller sea lions commonly occur near the 200-m (660-ft) depth contour, but individuals occur from nearshore to well beyond the continental shelf. Some individuals may enter rivers in pursuit of prey (USDOC, NMFS, 2008c). Steller sea lions eat a variety of fishes and cephalopods and occasionally birds and seals (Zimmerman and Rehberg, 2008). Older juveniles can dive to depths of 500 m (1,500 ft) and can stay underwater for >16 minutes (Zimmerman and Rehberg, 2008). However, dive depths of juveniles generally do not exceed 20 m (66 ft), while adults will dive to depths >250 m (820 ft) (USDOC, NMFS, 1993).

Steller sea lion rookeries and hundreds of haulouts occur within the range of the Western Stock of the Steller sea lion (USDOC, NMFS, 2008c; Allen and Angliss, 2011). The locations of the rookeries and haulouts change little from year to year (USDOC, NMFS, 1993). Major rookeries in and near Cook Inlet include Outer Island, Sugarloaf Island, Marmot Island, Chirikof Island, and Chowiet Island. There are several major haulouts in and near Cook Inlet, 37 km (20 nmi) aquatic zones, and an aquatic foraging area in Shelikof Strait. All of these are part of Steller sea lion critical habitat (**Figure C-32**). Breeding and pupping occur on rookeries; rookeries normally are on relatively remote islands, rocks, reefs, and beaches, where access by terrestrial predators is limited. Rookeries normally are occupied from late May through early July (USDOC, NMFS, 1993). Haulouts are areas used for rest and refuge by all sea lions during the non-breeding season and by non-breeding adults and subadults during the breeding season. Some rookeries are used as haulouts after the breeding season is over. In addition to rocks, reefs, and beaches normally used as haulouts, sea lions also may use sea ice and man-made structures such as breakwaters, navigational aids, and floating docks (USDOC, NMFS, 1993). Sea lion critical habitat includes a 32 km (20 nmi) buffer around all major haulouts and rookeries, as well as associated terrestrial, air, and aquatic zones. Special foraging areas in Alaska also have been designated critical habitat for Steller sea lions including the Shelikof Strait area of the Gulf of Alaska, the Bogoslof area in the Bering Sea shelf, and the Seguam Pass area in the central Aleutian Islands (USDOC, NMFS, 1993). The minimum population estimate for the Steller sea lion western stock is 48,676 (Allen and Angliss, 2014).

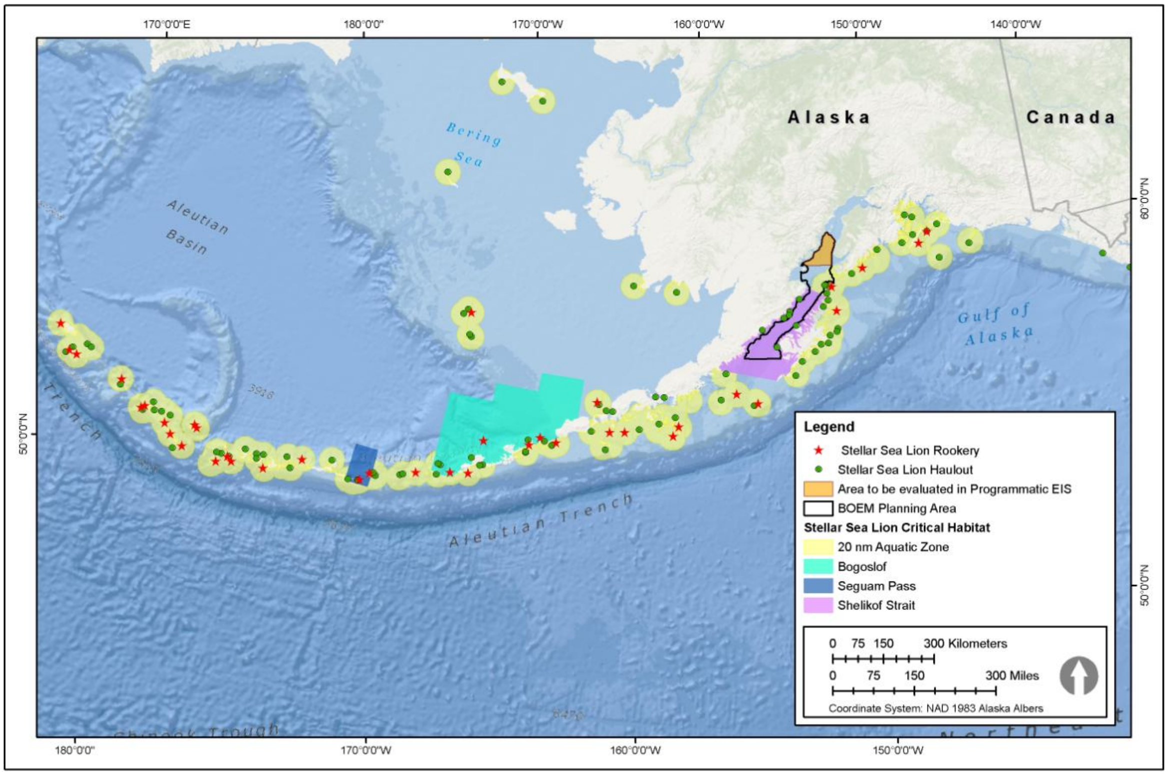


Figure C-32. Critical Habitat of the Steller Sea Lion.Northern Sea Otter (*Enhydra lutris*)

The sea otter (*Enhydra lutris*) inhabits shallow water areas along the shores of the North Pacific. Three stocks of the sea otter occur in Alaskan waters: (1) Southwest Alaska, extending from western lower Cook Inlet southwest through the Alaska Peninsula to the Aleutian Islands; (2) South Central Alaska, between Cape Yukataga and the lower east coast of Cook Inlet; and (3) Southeast Alaska, extending from the U.S.-Canada border to Cape Yukataga (Gorbics and Bodkin, 2001). Individuals from both the South Central and Southwest Alaska Stocks occur in the Cook Inlet Planning Area. The Southwest Alaska Stock has declined dramatically over the past several decades, probably due to predation by killer whales (Estes et al., 2009), causing the USFWS to list that stock as a threatened DPS under the ESA (USDOI, USFWS, 2006b).

Five units totaling 15,164 km^2 (5,855 mi^2) are designated as critical habitat for the Southwest Alaska DPS (USDOI, USFWS, 2009c) (**Figure C-33**). Unit 5 (Kodiak, Kamishak, Alaska Peninsula), containing 6,755 km^2 (2,607 mi^2) of critical habitat (USDOI, USFWS, 2009c), is the most likely to be affected by activities related to lease sales in Cook Inlet. This unit ranges from Castle Cape in the west to Tuxedni Bay in the east, and includes the Kodiak Archipelago (USDOI, USFWS, 2009c). The unit includes the nearshore marine environment ranging from the mean high tide to the 20-m (66-ft) depth contour as well as waters occurring within 100 m (330 ft) of the mean high tide line (USDOI, USFWS, 2009c). The lower western half of Cook Inlet to Redoubt Point is included in Unit 5 of the critical habitat (USDOI, USFWS, 2009c).

The sea otter inhabits coastal waters <90 m (295 ft) deep, with the highest densities usually found within the 40-m (130-ft) depth contour where young animals and females with pups forage. Preferred habitat includes rocky reefs, offshore rocks, and kelp beds. Sea otters in Alaska are not migratory and, while capable of movements over more than 100 km (60 mi), generally do not disperse over long distances (USDOI, USFWS, 2014). They sometimes will rest in groups of fewer than 10 to >1,000 individuals. Sea otters seldom come onshore, and when they do, they are seldom more than a few meters from water (Reidman and Estes, 1990).

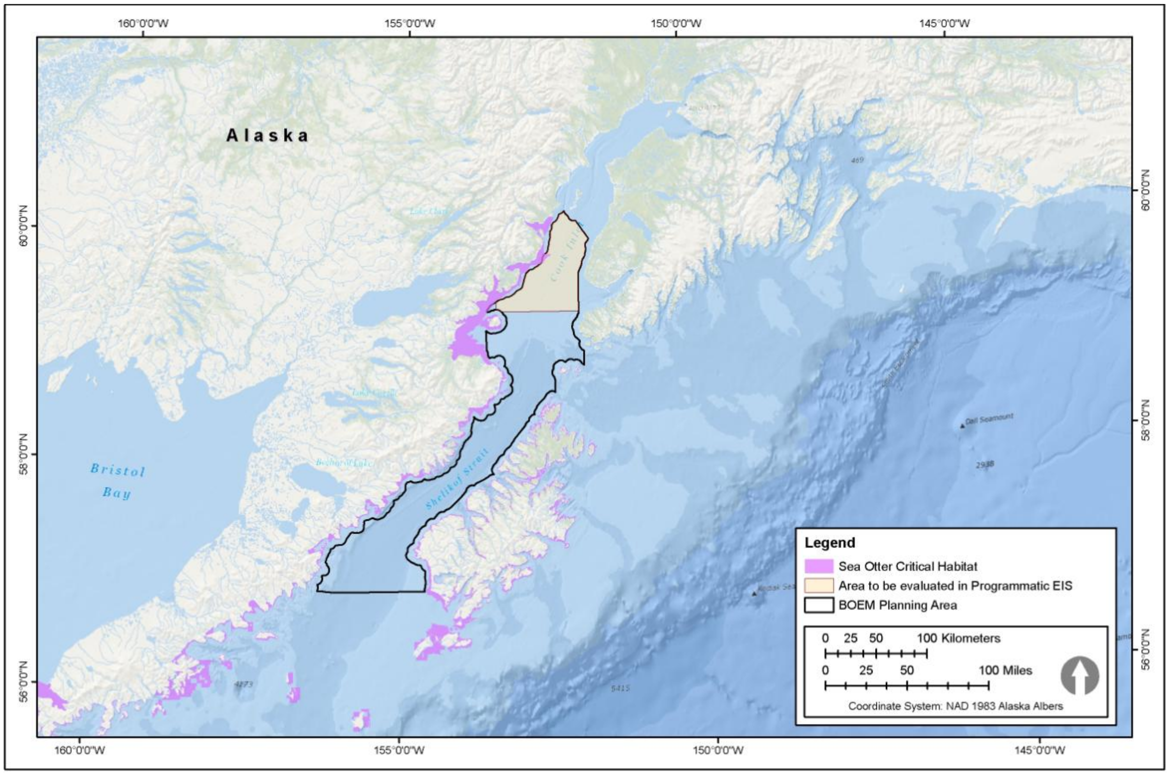


Figure C-33. Critical Habitat of the Northern Sea Otter.

The recovery and expansion of the sea otter populations in Prince William Sound and in southeast Alaska, coupled with the otter's preference for crab and clam species that are of commercial interest (such as Dungeness crab (*Metacarcinus magister*) and butter clam [*Saxidomus giganteus*]) (Garshelis et al., 1986; Kvitek et al., 1993), has resulted in competition and conflict with commercial-fishing interests (Garshelis and Garshelis, 1984; USDOI, USFWS, 2014). Among marine mammals, sea otters probably have one of the higher reproductive rates and a potential for fairly rapid population recovery (such as 17 to 20 percent yr^{-1} [Riedman et al., 1994]) after substantial losses due to natural or man-made causes such as overharvest or an oil spill.

The current estimate for the Southwest Alaska Stock is 54,771 sea otters, with a minimum population estimate of 45,064, while the current estimate for the South Central Alaska Stock is 18,297 sea otters, with a minimum population estimate of 14,661. Of these, 962 sea otters occur in Cook Inlet (USDOI, USFWS, 2014). The South Central Alaska Stock's population trend is stable, while the Southwest Alaska Stock is declining (USDOI, USFWS, 2014). The cause of the population decline is not known for sure, but weight of evidence indicates increased predation by killer whales as the most likely cause. The most important threats to recovery of the population are predation and oil spills; other threats to recovery include subsistence harvest, illegal take, and infectious disease (USDOI, USFWS, 2010c).

5.1.2.2. Not Listed under the Endangered Species Act

Seven species of cetaceans and one species of pinniped, not listed under the ESA, occur in Cook Inlet Alaska. The mysticetes account for two of these species while five species are odontocetes. There is one species of pinniped. Appropriate information for each species or species group is provided in **Table C-11**.

Table C-11. Information on Non-Listed Marine Mammals Species Occurring in the Cook Inlet Program Area.

Non-Listed Species	Distribution	Abundance Estimate	Abundance Estimate Minimum	Last Survey
Gray whale (*Eschrichtius robustus*)	• Consists of the Eastern North Pacific Stock • The endangered Western North Pacific Stock has been observed in coastal waters of Canada and the U.S. (Carretta et al., 2014) • Present in the feeding season in the Gulf of Alaska in late March and April	19,126	18,017	2007
Minke whale (*Balaenoptera acutorostrata*)	• Occurs from Bering Sea and Chukchi Sea south to near the equator with apparent concentrations near Kodiak Island (Allen and Angliss, 2014) • In the spring found over continental shelf and prefer shallow coastal waters	N/A	N/A	N/A
Cuvier's beaked whale (*Ziphius cavirostris*)	• Occurs in the northeastern Pacific from Baja, California to the northern Gulf of Alaska, Aleutian Islands and Commander Islands (Allen and Angliss, 2014) • Prefers waters of the continental slope and edge, and steep underwater geologic features such as banks, seamounts, and submarine canyons where depths are >1,000 m (3,000 ft) (USDOC, NMFS, 2015)	N/A	N/A	N/A
Dall's porpoise (*Phocoenoides dalli*)	• Present year-round throughout its entire range in the northeast Pacific from Baja California, Mexico, to the Bering Sea in Alaska • Occurs in Cook Inlet Planning Area except for upper Cook Inlet (Allen and Angliss, 2014) • Occurs over the continental shelf adjacent to the slope and over oceanic waters >2,500 m (8,200 ft) deep (Allen and Angliss, 2014)	83,400	N/A	1993
Harbor porpoise (*Phocoena phocoena*)	• Occurs from Point Barrow along the Alaskan coast and down to the west coast of North America to Point Conception, California (Allen and Angliss, 2014) • Frequent waters <100 m (328 ft) in depth with high densities of animals occurring in Glacier Bay, Yakutat Bay, Copper River Delta, and Sitkalidak Strait (Dalheim et al., 2000) • Gulf of Alaska Stock occurs from Cape Suckling to Unimak Pass (Allen and Angliss, 2014)	31,046	25,987	1998
Killer whale (*Orcinus orca*)	• Occurs along the entire Alaskan coast within the Chukchi Sea, Bering Sea, Aleutian Islands, Gulf of Alaska, Prince William Sound, Kenai Fjords, and southeastern Alaska. • Common in lower but not upper Cook Inlet (Shelden et al., 2003)	2,347 / 587	2,347 / 587	2012/2012

Table C-11. Information on Non-Listed Species of Marine Mammals Occurring in the Cook Inlet Program Area (Continued).

Non-Listed Species	Distribution	Abundance Estimate	Abundance Estimate Minimum	Last Survey
Pacific white-sided dolphin (*Lagenorhychus obliquidens*)	• Occurs in the eastern North Pacific from the southern Gulf of California, north to the Gulf of Alaska and west to Amchitka in the Aleutian Islands • Generally occurs offshore over the continental slope in waters from 200 to 2,000 m (656 to 6,560 ft) deep (Stacey and Baird, 1991; Consiglieri et al., 1982) • Occurs in inshore passes of Alaska (Stacey and Baird, 1991; Consiglieri et al., 1982; Ferrero and Walker, 1996)	26,880	N/A	1990
Harbor seal (*Phoca vitulinea richardsi*)	• Occurs along the southeast Alaska coastline west through the Gulf of Alaska and Aleutian Islands and into the Bering Sea north to Cape Newenham and the Pribilof Islands (Allen and Angliss, 2014) • Cook Inlet and Shelikof Stocks potentially affected by oil and gas activities occuring from Cape Suckling to Unimak Pass • Haul out near available prey and in secure areas that avoid high anthropogenic disturbance	22,900	21,896	2006
Northern fur seal (*Callorhinus ursinus*)	• Occur from southern California north to the Bering sea (Caretta et al., 2014) • Consists of the Eastern Pacific Stock (Allen and Angliss, 2014) • Pups are born during the summer in Alaska and leave the rookeries between late October to early December (Allen and Angliss, 2014)	648,534	548,919	2011

Abundance data taken from Allen and Angliss (2014) Stock Assessment except for the gray whale. Gray whale abundance data taken from Carretta et al. (2014).

N/A = not available

5.2. GULF OF MEXICO PROGRAM AREA

This section provides a regional summary description of marine and terrestrial mammals in the Gulf of Mexico Program Area including the Western Planning Area, Central Planning Area, and Eastern Planning Area (Figure 2.1-2 of the Programmatic EIS).

5.2.1. Marine Mammals

5.2.1.1. Listed under the Endangered Species Act

There are seven marine mammal species that potentially could occur in the Gulf of Mexico Program Area that are federally listed as endangered species (USDOC, NMFS, 2011e). These include five baleen whales: the North Atlantic Right Whale (NARW; *Eubalaena glacialis*), sei whale, blue whale, fin whale, and humpback whale; one toothed whale, the sperm whale; and the Florida subspecies of the West Indian manatee (*Trichechus manatus*) (Waring et al., 2010; USDOC, NMFS, 2011e). The sperm whale is common in OCS waters (shelf edge and slope) of the Gulf of Mexico Program Area (**Figure C-34**). The West Indian manatee occurs regularly in the Gulf of Mexico, whereas the other listed marine mammal species are considered rare and/or extralimital (Würsig et al., 2000; Mullin and Fulling 2004).

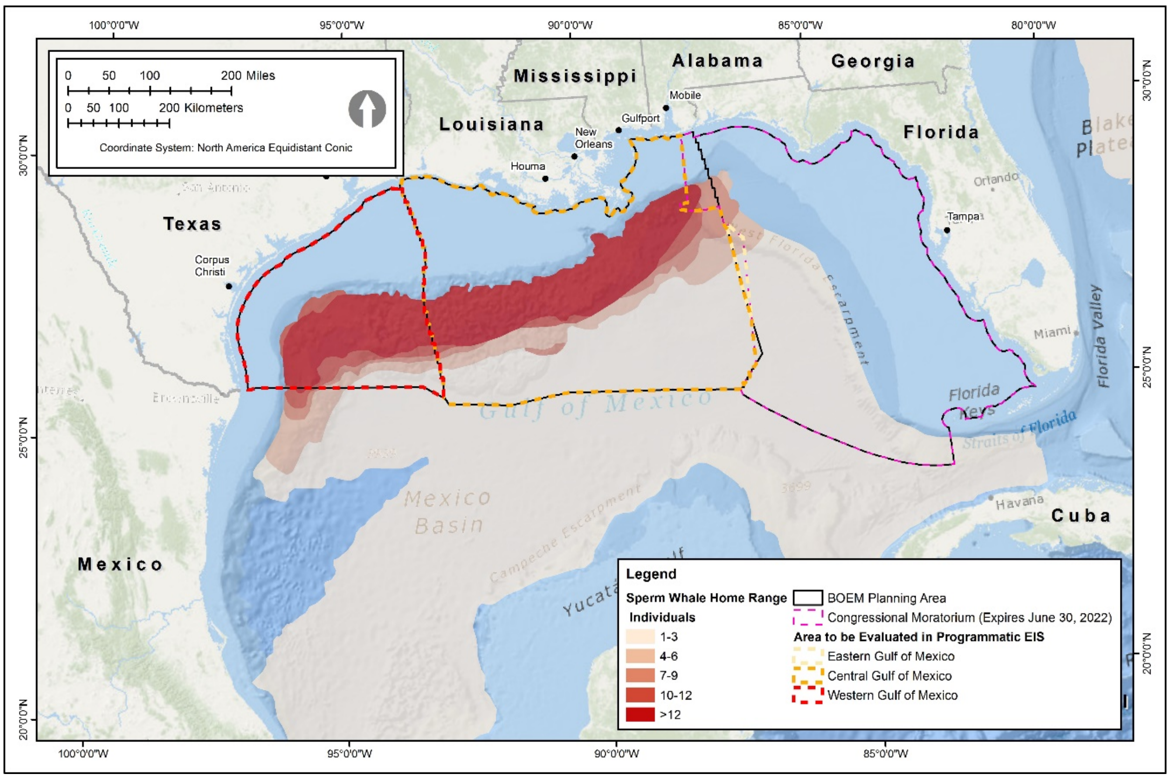


Figure C-34. Spatial Representation of Sperm Whale Home Range in the Gulf of Mexico (From: USDOI, BOEM and USDOI, MMS, 2008).

North Atlantic Right Whale (*Eubalaena glacialis*)

There are few verified records of NARW in the Gulf of Mexico. The first was a stranding of a calf or young-of-the-year off the coast of Texas in 1972. The second involved two whales in mid-March to early April 2004 off the Florida Panhandle; these individuals were observed first in January off Miami and later re-sighted in June off the coast of Cape Cod. The third and fourth sightings were of a cow-calf pair first seen in Corpus Christi Bay in southern Texas and then re-sighted off Longboat Key, Florida. Waring et al. (2013) characterize Gulf of Mexico NARW occurrences as geographic anomalies, normal wanderings, or representative of a more extensive historic range beyond the known calving and wintering ground in the waters of the southeastern U.S. NARWs currently are considered extralimital to the Gulf of Mexico (Würsig et al., 2000; Waring et al., 2010).

Sei Whale (*Balaenoptera borealis*)

Few reliable records of sei whales exist for the Gulf of Mexico, where they are considered rare (Würsig et al., 2000). The stock identity of individual sei whales that may enter the Gulf of Mexico is not known. The total number of sei whales in the U.S. Atlantic EEZ (including the Gulf of Mexico) is unknown (Waring et al., 2014).

Blue Whale (*Balaenoptera musculus*)

In the Atlantic, blue whales are found from the Arctic to at least mid-latitude waters, and typically inhabit the open ocean with occasional occurrences in the U.S. EEZ (Gagnon and Clark, 1993; Wenzel et al., 1988; Yochem and Leatherwood, 1985). Yochem and Leatherwood (1985) summarized records suggesting winter range extends south to Florida and the Gulf of Mexico, although the actual southern limit of the species' range is unknown. Reports of blue whales from the Gulf of Mexico are from stranded individuals only, and their presence there is considered accidental, or extralimital (Würsig et al., 2000).

Fin Whale (*Balaenoptera physalus*)

Fin whales occur during the summer from Baffin Bay to near Spitsbergen and the Barents Sea, south to Cape Hatteras, North Carolina, and off the coasts of Portugal and Spain (Rice, 1998a). Little is known about the winter habitat of fin whales, but in the western North Atlantic, the species has been found from Newfoundland south to the Gulf of Mexico and Greater Antilles, and in the eastern North Atlantic their winter range extends from the Faroes and Norway south to the Canary Islands. A general fall migration from the Labrador and Newfoundland region, south past Bermuda, and into the West Indies has been theorized (Clark, 1995). The fin whale is the most frequently reported non-resident mysticete in the Gulf of Mexico, although it is likely that sighted individuals are strays from the North Atlantic population (Würsig et al., 2000).

Humpback Whale (*Megaptera novaeangliae*)

Historical sightings suggest that humpback whales are uncommon in the Gulf of Mexico, although individuals have been recorded within inner shelf waters offshore Texas, Alabama, and Florida. One was recorded in oceanic waters offshore Louisiana (Würsig et al., 2000).

Sperm Whale (*Physeter macrocephalus*)

Sperm whales are cosmopolitan in their distribution, ranging from tropical latitudes to pack ice edges in both hemispheres. In the Gulf of Mexico, sperm whales can be found in the Central Planning Area. The International Whaling Commission currently recognizes four sperm whale stocks: North Atlantic, North Pacific, Northern Indian Ocean, and Southern Hemisphere (Reeves and Whitehead, 1997 Dufault et al., 1999). Genetic studies indicate that movements of both sexes through expanses of ocean basins are common, and that males, but not females, often breed in different ocean basins than the ones in which they were born (Whitehead, 2003). Matrilinear groups in the eastern Pacific share nuclear DNA within broader clans, but North Atlantic matrilinear groups do not share this genetic heritage (Whitehead et al., 2012). Genetic studies of Gulf of Mexico sperm whales found significant genetic differentiation in matrilineally inherited mitochondrial DNA among whales from the northern Gulf of Mexico and animals examined from the western North Atlantic Ocean, North Sea, and Mediterranean Sea. However, similar comparisons of biparentally inherited nuclear DNA showed no significant difference between Gulf of Mexico whales and whales from the other areas of the North Atlantic. Overall results of these studies indicate that some mature male sperm whales move in and out of the Gulf of Mexico (Engelhaupt et al., 2009). Results from satellite tagging studies of individual Gulf of Mexico sperm whales found no evidence of seasonal migrations of groups to outside the Gulf of Mexico, but documented Gulf of Mexico-wide movements, primarily along the northern continental slope and in a few cases into the southern Gulf of Mexico. Only one individual, an adult male sperm whale left the Gulf of Mexico for the North Atlantic and returned after a period of approximately 2 months (Jochens et al., 2008).

Sperm whale vocalization demonstrates distinct patterns, called “codas,” that are believed to be culturally transmitted. Coda patterns have been examined and, based on degree of social affiliation of these patterns, can be used to place mixed groups of sperm whales worldwide in discrete “acoustic clans” (Watkins and Schevill, 1977; Whitehead and Weilgart, 1991; Rendell and Whitehead, 2001; Rendell and Whitehead, 2003). These vocal dialects indicate parent-offspring transmission suggesting differentiation in populations (Rendell et al., 2011). Coda patterns from mixed groups of sperm whales in the Gulf of Mexico were compared to those from other areas of the Atlantic, and suggested that the Gulf of Mexico whales may constitute a distinct acoustic clan. However, the study also found variation in coda patterns between animals in the north-central Gulf of Mexico and the northwest Gulf of Mexico. From these results, it was suggested that groups of whales from other acoustic clans (e.g., from the North Atlantic) occasionally may enter the northern Gulf of Mexico (Gordon et al., 2008).

The total length of Gulf of Mexico sperm whales are approximately 1.5-2.0 m (4.9-6.6 ft) smaller than sperm whales measured in other areas (Waring et al., 2013). Based on tagging data, older males may enter the Gulf of Mexico only for breeding, but then may not migrate out of the Gulf of Mexico (78 FR68032). Sperm whale group size in the Gulf of Mexico is smaller on average than in other oceans; however, their group size is variable throughout their global range. For example, the group size of females and immature sperm whales in the Gulf of Mexico is about one-third to one-fourth that of sperm whales in the Pacific Ocean, but similar to group sizes observed in the Caribbean (Richter et al., 2008; Jaquet and Gendron, 2009).

In summary, although movements between the North Atlantic and Gulf of Mexico have been documented, Gulf of Mexico individuals are genetically distinct from their Mediterranean and North Atlantic relatives (Engelhaupt, 2004; Waring et al., 2013). The acoustic dialect used by this group is also different than that of other sperm whales in the North Atlantic (Waring et al., 2013). For these and other reasons including average size and photo-identification, sperm whales in the Gulf of Mexico constitute a Northern Gulf of Mexico Stock that is distinct from other Atlantic Ocean stocks (Waring et al., 2013).

In the Gulf of Mexico, systematic aerial and ship surveys indicate that sperm whales are widely distributed during all seasons in continental slope and oceanic waters, particularly along and seaward of the 1,000-m (3,280-ft) depth contour and within areas of steep depth gradients (**Figure C-35**) (Mullin et al., 1991, 1994, 2004; Hansen et al., 1996; Jefferson and Schiro, 1997; Davis et al., 1998; Mullin and Hoggard, 2000; Ortega Ortiz, 2002; Fulling et al., 2003; Mullin and Fulling, 2004; Maze-Foley and Mullin, 2006; Mullin, 2007; Jefferson et al., 2008). The spatial distribution of sperm whales within the Gulf of Mexico is also strongly correlated with mesoscale physical features such as Loop Current eddies that locally increase primary production and the availability of prey (Biggs et al., 2005). Cold-core eddy features are attractive to sperm whales in the Gulf of Mexico, likely because of the large numbers of squid that are drawn to the high concentrations of plankton associated with these features (Biggs et al., 2000; Davis et al., 2000, 2002; Wormuth et al., 2000).

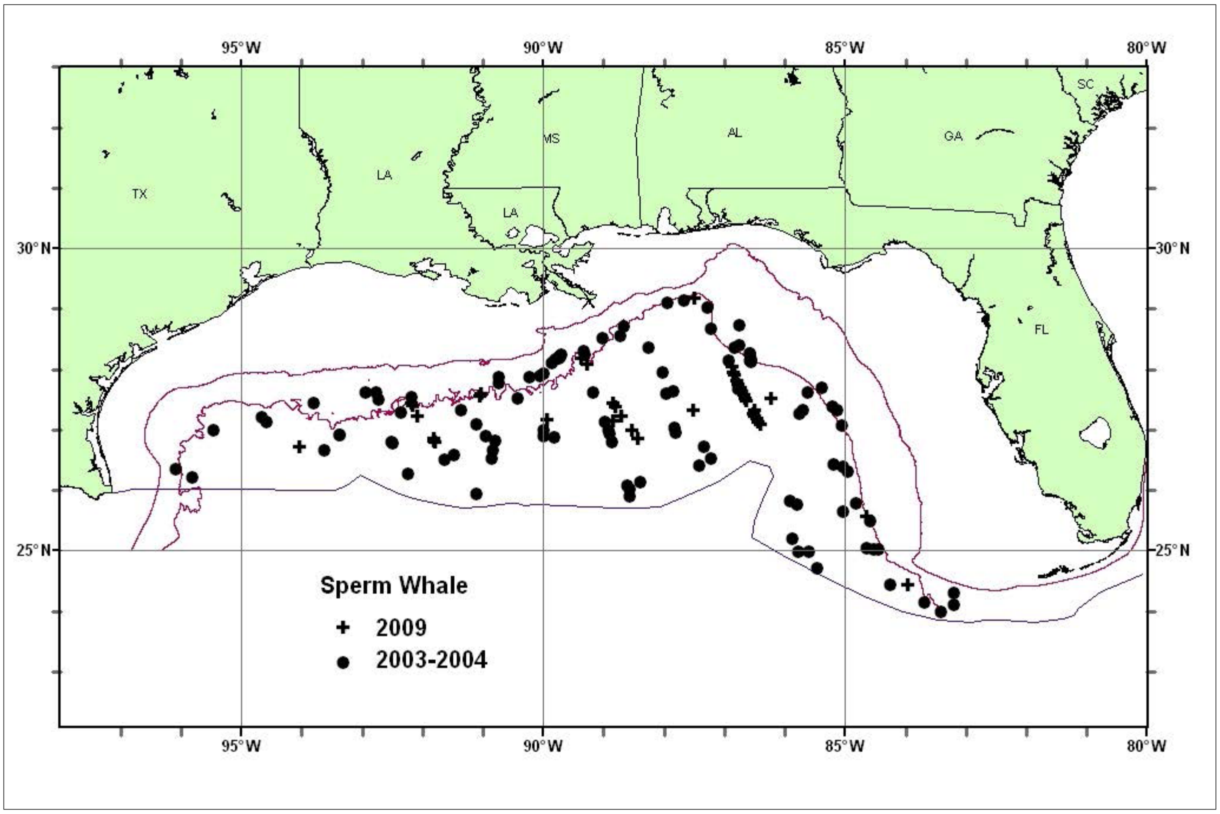


Figure C-35. Gulf of Mexico Sperm Whale Sightings From Vessel Surveys During Summer 2003, Spring 2004, and Summer 2009. Solid Lines Indicate the 100-m and 1,000-m (328-ft and 3,280-ft) Depth Contours and the Offshore Extent of the U.S. EEZ (From: Waring et al., 2012).

The best abundance estimate available for northern Gulf of Mexico sperm whales, derived from a summer 2009 oceanic survey, is 763 individuals (coefficient variation [CV] = 0.38) (Waring et al., 2013). The minimum population estimate resulting from these data is 560 sperm whales. From 1991 through 1994, and from 1996 through 2001 (excluding 1998), annual surveys were conducted during spring along a fixed plankton-sampling trackline. Due to limited survey effort in any given year, the survey effort-weighted estimated average abundance of sperm whales for all surveys combined was estimated. For 1991 to 1994, the estimate was 530 individuals (CV = 0.31) (Hansen et al., 1996), and for 1996 to 2001, 1,349 individuals (CV = 0.23) (Mullin and Fulling, 2004). During summer 2003 and spring 2004, surveys dedicated to estimating cetacean abundance were conducted along a grid of uniformly spaced transect lines from a random start. The abundance estimate for sperm whales, pooled from 2003 to 2004, was 1,665 individuals (CV = 0.20) (Mullin, 2007).

Jochens et al. (2006) estimated the number of sperm whales off the Mississippi River Delta to be 398 (confidence interval [CI] = 253-607). Mullin et al. (2004) estimated the number of whales in the north-central and northwestern Gulf of Mexico at 87 (95 percent CI = 52-146).

The current potential biological removal for Gulf of Mexico sperm whales is 1.1 individuals (Waring et al., 2013). NMFS has not designated critical habitat for sperm whales. Sperm whales were widely harvested from the northeastern Caribbean (Romero et al., 2001) and the Gulf of Mexico, where sperm whale fisheries operated during the late 1700s to the early 1900s (Townsend, 1935). Presumably from the effects of whaling pressure, sperm whale populations remain small. Because of their small size, small changes in reproductive parameters such as the loss of adult females, may significantly affect the growth of sperm whale populations (Chiquet et al., 2013). No population trends can be interpreted from data available for the Gulf of Mexico. Changes in abundance will be difficult to interpret without an understanding of sperm whale abundance throughout the Gulf of Mexico. Studies based on abundance and distribution surveys restricted to U.S. waters are unable to detect temporal shifts in their distribution beyond U.S. waters that might account for any changes in abundance (Waring et al., 2013).

West Indian Manatee (Florida subspecies) (*Trichechus manatus latirostris*)

Studies of the manatee (*Trichechus manatus latirostris*) in Florida identified four regional management units (formerly referred to as subpopulations), including two units within the Gulf of Mexico: a Northwest Unit from the Florida Panhandle south to Hernando County; and a Southwest Unit from Pasco County south to Whitewater Bay in Monroe County (USDOI, USFWS, 2001 and 2007). While the Florida manatee population has been separated into these management units, the USFWS identifies the Florida manatee population as a single stock. Significant genetic differences between the manatees of Florida and Puerto Rico do exist and, as a result, these populations are identified as separate stocks (Vianna et al., 2006). Vianna et al. (2006) identified a gene flow barrier between stocks in Florida and Puerto Rico using mitochondrial DNA analyses.

The Florida manatee subspecies is found throughout the southeastern U.S., with individuals sighted as far north as Massachusetts and as far west as Texas (Rathbun et al., 1982; Schwartz, 1995; Fertl et al., 2005). The Antillean manatee subspecies is found in the southern Gulf of Mexico off eastern Mexico and Central America, in northern and eastern South America, and in the Greater Antilles (Lefebvre et al., 1989), therefore its range is outside of the area of interest (AOI).

5.2.1.2. Not Listed under the Endangered Species Act

Twenty-two species of cetaceans, not listed under the ESA, occur in the Gulf of Mexico. Mysticetes (baleen whales) account for two of these species while the other 20 species are odontocetes (toothed whales and dolphins). A year-round BIA has been designated for the resident Bryde’s whale population in the Eastern Planning Area (**Figure C-36**). Certain management stocks of common bottlenose dolphin (*Tursiops truncatus*) (Coastal, and Bay, Sound, and Estuary Stocks) found in coastal waters throughout the Gulf of Mexico Program Area are listed as strategic stocks under the MMPA, and so receive additional protection (**Figure C-37**). Additional information relative to each species or species group is provided in **Table C-12**.

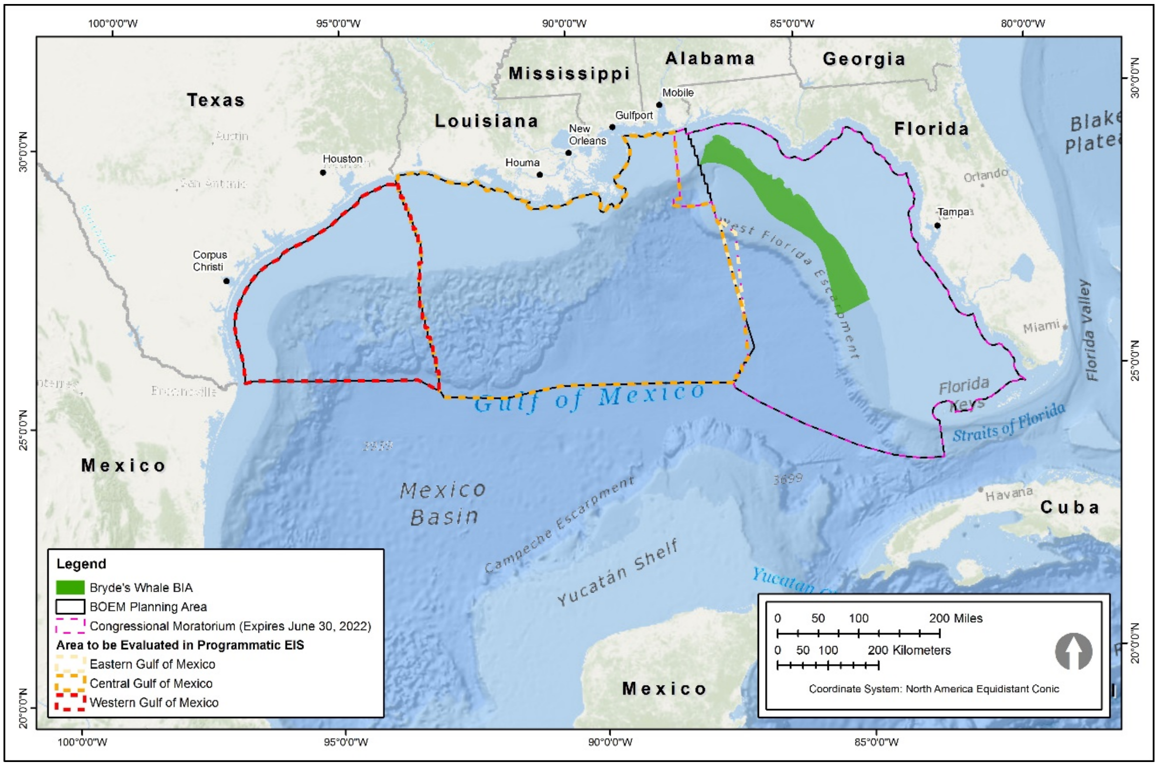


Figure C-36. Spatial Representation of Bryde's Whale Biologically Important Area in the Gulf of Mexico (Data from: USDOC, NOAA).

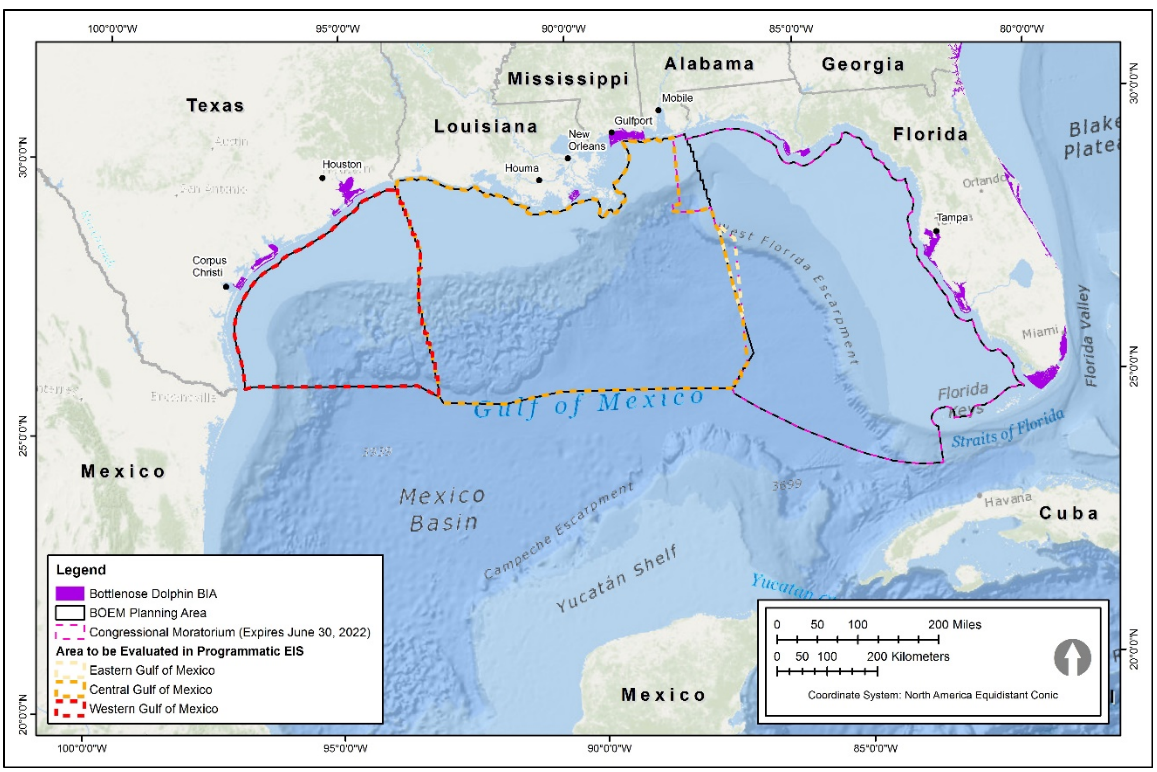


Figure C-37. Spatial Representation of Bottlenose Dolphin Biologically Important Area in the Gulf of Mexico. (Data from: USDOC, NOAA).

Table C-12. Information on Non-listed Marine Mammal Species Occurring in the Gulf of Mexico

Non-Listed Species	Distribution	Abundance Estimate	Abundance Estimate Minimum	Last Survey
Bryde's whale (*Balaenoptera edeni*)	• Distributed globally in tropical and subtropical waters of the world (Omura, 1959, Kato, 2002) • Occur in both coastal and pelagic waters • Sighted in shelf break waters or near topographic features such as the DeSoto Canyon or Florida Escarpment in GOM	33	16	2009
Atlantic spotted dolphin (*Stenella frontalis*)	• Endemic and common in tropical and temperate waters of the Atlantic Ocean • May conduct seasonal nearshore-offshore movements in response to the availability of prey species (Würsig et al., 2000) • Current population size in the northern GOM is unknown	N/A	N/A	N/A
Bottlenose dolphin (*Tursiops truncatus*)	• Inhabit the northern GOM and are currently divided into the following management stocks (Waring et al., 2014): • Northern GOM Oceanic Stock encompasses the waters from the 200 m (656 ft) depth contour to the seaward extent of the U.S. EEZ; • Northern GOM Continental Shelf Stock inhabits waters from 20 to 200 m (66 to 656 ft) deep from the U.S.-Mexican border to the Florida Keys; • GOM Coastal Stocks (comprising three individual stocks [Eastern Coastal Stock, Northern Coastal Stock, Western Coastal Stock]) inhabit the northern GOM coastal waters with water depths <20 m (66 ft); and • Northern GOM Bay, Sound, and Estuary Stocks (comprising 32 individual stocks) that are in areas of contiguous, enclosed, or semi-enclosed bodies of water adjacent to the northern GOM.	Northern GOM Oceanic: 5,806 Northern GOM Continental: 51,192 GOM Coastal: Eastern: 12,388; Northern: 7,185; Western: 20,161 Northern GOM B/S/E (available estimates combined): 325	Northern GOM Oceanic: 4,230 Northern GOM Continental: 46,926 GOM Coastal: Eastern: 11,110; Northern: 6,044; Western: 17,491 Northern GOM B/S/E (available estimates combined): 299	Northern GOM Oceanic: 2009 Northern GOM Continental: 2011 GOM Coastal: Eastern: 2011; Northern: 2011; Western: 2011 Northern GOM B/S/E: 2007/2008
Clymene dolphin (*Stenella clymene*)	• Restricted to tropical and warm temperate waters of the Atlantic Ocean, including the Caribbean Sea and GOM • Deepwater oceanic species and considered relatively common in oceanic waters (Würsig et al., 2000; Jefferson, 2002b; Jefferson et al., 2008) • Sighted offshore Louisiana in every season of the GulfCet surveys	129	64	2009

Table C-12. Information on Non-listed Marine Mammal Species Occurring in the Gulf of Mexico (Continued).

Non-Listed Species	Distribution	Abundance Estimate	Abundance Estimate Minimum	Last Survey
False killer whale (*Pseudorca crassidens*)	• Distributed worldwide throughout warm temperate and tropical oceans, generally in relatively deep, offshore waters from 60° S to 60° N (Stacey et al., 1994; Odell and McClune, 1999; Baird, 2002a; Waring et al., 2013) • Historic sightings in the northern GOM are from oceanic waters (Mullin and Fulling, 2004; Maze-Foley and Mullin, 2006)	N/A	N/A	N/A
Fraser's dolphin (*Lagenodelphis hosei*)	• Pantropical species, distributed largely between 30° N and 30° S in the Atlantic, Pacific, and Indian Oceans (Jefferson et al., 2008) • Sightings in the northern GOM have been recorded during all seasons in water depths >200 m (656 ft) (Leatherwood et al., 1993; Hansen et al., 1996; Mullin and Hoggard, 2000; Maze-Foley and Mullin, 2006)	N/A	N/A	N/A
Killer whale (*Orcinus orca*)	• Distribution is cosmopolitan • Historic sightings in the northern GOM from 1921 to 1995 occurred primarily in oceanic waters ranging from 256 to 2,652 m (839 to 8,700 ft) (averaging 1,242 m [4,074 ft]), primarily in the north-central GOM (O'Sullivan and Mullin, 1997) • Characterized as uncommon or rare in waters of the U.S. Atlantic EEZ (Katona et al., 1988; Waring et al., 2014)	28	14	2009
Melon-headed whale (*Peponocephala electra*)	• Distributed worldwide in tropical to subtropical waters (Jefferson et al., 2008) • Generally found in oceanic waters with nearshore sightings limited to areas where deep waters are found near the coast (Perryman, 2002) • Sightings in the northern GOM have generally occurred in water depths >800 m (2,625 ft) and usually offshore Louisiana to west of Mobile Bay, Alabama (Mullin et al., 1994; Mullin and Fulling, 2004; Maze-Foley and Mullin, 2006)	2,235	1,274	2009

Table C-12. Information on Non-listed Marine Mammal Species Occurring in the Gulf of Mexico (Continued).

Non-Listed Species	Distribution	Abundance Estimate	Abundance Estimate Minimum	Last Survey
Pantropical spotted dolphin (*Stenella attenuata*)	• Primarily distributed within offshore (oceanic) tropical zones • Most common cetacean within deep GOM waters • Most sightings between the 100- and 2,000-m (328- and 6,565-ft) depth contours (Würsig et al., 2000)	50,880	40,699	2009
Pygmy killer whale (*Feresa attenuata*)	• Distributed worldwide in tropical to subtropical oceanic waters • Historic sightings in the northern GOM are within oceanic waters (Mullin and Fulling, 2004; Maze-Foley and Mullin, 2006)	152	75	2009
Risso's dolphin (*Grampus griseus*)	• Distributed worldwide in tropical to warm temperate waters (Leatherwood and Reeves, 1983) • Occur throughout oceanic waters of the northern GOM but are concentrated in areas of the continental slope (Baumgartner, 1997; Maze-Foley and Mullin, 2006)	2,442	1,563	2009
Rough-toothed dolphin (*Steno bredanensis*)	• In the GOM, rough-toothed dolphins occur in oceanic and to a lesser extent continental shelf waters (Fulling et al., 2003; Mullin and Fulling, 2004; Maze-Foley and Mullin, 2006)	624	311	2009
Short-finned pilot whale (*Globicephala macrorhynchus*)	• Distributed worldwide in tropical to subtropical waters, generally on the continental shelf break and in deep oceanic waters (Leatherwood and Reeves, 1983; Jefferson et al., 2008) • Historical sightings of these animals in the northern GOM have been primarily on the continental slope, west of 89˚W longitude (Mullin and Fulling, 2004; Maze-Foley and Mullin, 2006)	2,415	1,456	2009
Spinner dolphin (*Stenella longirostris*)	• Distributed worldwide in tropical to temperate oceanic waters • Sightings in the northern GOM occur in oceanic waters, generally east of the Mississippi River (Mullin and Fulling, 2004; Maze-Foley and Mullin, 2006) • Recorded in all seasons during GulfCet aerial surveys of the northern GOM	11,441	6,221	2009

Table C-12. Information on Non-listed Marine Mammal Species Occurring in the Gulf of Mexico (Continued).

Non-Listed Species	Distribution	Abundance Estimate	Abundance Estimate Minimum	Last Survey
Striped dolphin (*Stenella coeruleoalba*)	• Widely distributed, ranging from tropical to cool temperate waters within the Atlantic, Pacific, and Indian Oceans • Sightings of these animals in the northern GOM also occur in oceanic waters (Mullin and Fulling, 2004; Maze-Foley and Mullin, 2006) • Seen in all seasons during GulfCet aerial surveys of the northern GOM	1,849	1,041	2009
Dwarf sperm whale (*Kogia sima*)	• Occur year-round in GOM • Sighted in warmer waters (Caldwell and Caldwell, 1989) • Pelagic and deeper divers than pygmy sperm whale (Barros et al., 1998)	186	90	2009
Pygmy sperm whale (*Kogia breviceps*)	• Occur year-round in GOM • Sighted in water depths of 100 to 2,000 m (328 to 6,562 ft) (Barros et al., 1998)	186	90	2009
Beaked whales (*Mesoplodon*): Blainville's beaked whale (*Mesoplodon densirostris*) Gervais' beaked whale (*Mesoplodon europaeus*) Sowerby's beaked whale (*Mesoplodon bidens*)	• In the GOM, beaked whales have been sighted during all seasons and in waters with bottom depths ranging from 420 to 3,487 m (1,378 to 11,440 ft) (Ward et al., 2005; Waring et al., 2009) • Sowerby's beaked whale is considered extralimital to the GOM (Waring et al., 2012) • Beaked whales are difficult to distinguish from each other • There have been two sightings and four documented strandings of Blainville's beaked whales in the northern GOM (Hansen et al., 1995; Würsig et al., 2000) • Gervais' beaked whale had 16 strandings occurring in the GOM (Würsig et al., 2000)	149	77	2009
Cuvier's beaked whale (*Ziphius cavirostris*)	• Found in deep offshore waters of all oceans from 60° N to 60° S (Jefferson et al., 1993) • Stranding records from East GOM along the Florida Coast • Sightings of live individuals were primarily within the central and western GOM, in areas of water depths of approximately 2,000 m (6,560 ft) (Würsig et al., 2000)	74	36	2009

Abundance data taken from Waring et al. (2014) and Waring et al. (2013) when the information was not provided in Waring et al., 2014.
N/A = not available; GOM = Gulf of Mexico.

5.2.1.3. Unusual Mortality Event for Cetaceans in the Gulf of Mexico

On December 13, 2010, NMFS declared aUME for cetaceans (whales and dolphins) in the Gulf of Mexico. A UME is defined under the MMPA as a “stranding that is unexpected, involves a significant die-off of any marine mammal population, and demands immediate response.” Evidence of the UME was first noted by NMFS in February 2010. As of July 12, 2015, a total of 1,411 cetaceans have stranded since the start of the UME (USDOC, NMFS, 2015b). Six percent of these stranded alive and 94 percent stranded dead. The vast majority of these strandings involved premature, stillborn, or neonatal bottlenose dolphins between Franklin County, Florida, and the Louisiana-Texas border (USDOC, NMFS, 2015b). The highest concentration of strandings has occurred off eastern Louisiana, Mississippi, Alabama, and the Florida Panhandle, with a lesser number off western Louisiana (USDOC, NMFS, 2012a). The 1,411 animals include 14 dolphins killed during a fish-related scientific study, and 1 dolphin killed incidental to a dredging operation (USDOC, NMFS, 2015b).

A recent tissue study has shown that petroleum contaminants were a likely source for the lung and adrenal lesions observed in the bottlenose dolphin (USDOC, NMFS, 2015c). However, different contributing factors are a part of the UME, and researchers have been comparing the number and demographics of bottlenose dolphin deaths from January 2010 to June 2013 with patterns from historical baseline data from 1990 to 2009. Balmer et al. (2008), suggest that concentrations of persistent organic pollutants in some populations of bottlenose dolphins likely were not a primary contributor to poor health conditions and increased mortality.

Investigations also are ongoing to determine what role *Brucella* (a genus of bacteria) may be having on the UME. Adverse effects of *Brucella* include abortion, meningoencephalitis (brain infection), pneumonia, skin infection (e.g., blubber abscesses), and bone infection (USDOC, NMFS, 2012a). As of November 25, 2014, 54 out of 179 dolphins tested positive for *Brucella* (USDOC, NMFS, 2015b). All marine mammals sampled, whether alive or dead, were found stranded east of the Louisiana-Texas border through Franklin County, Florida.

On May 9, 2012, NMFS declared a UME for the bottlenose dolphin off of Texas that lasted from November 2011 to March 2012 (USDOC, NMFS, 2015e). 126 dolphins stranded, including young dolphins <1 year old. The strandings coincided with a harmful algal bloom of *Karenia brevis,* though the cause of the UME remains unknown. This is the fifth UME off of Texas since 1994.

In April 2013, NOAA declared an UME for the manatee in Florida. A total of 130 manatee deaths were documented, with most carcasses recovered in Brevard County (Florida Fish and Wildlife Conservation Commission [FWC], 2015; USDOC, NMFS, 2015g). The cause for the UME is still undetermined.

5.2.1.4. Deepwater Horizon Event

The *Deepwater Horizon* event in Mississippi Canyon Block 252 and the resulting oil spill and related spill-response activities, including use of dispersants, have affected marine mammals that came into contact with oil and dispersants used during remediation efforts. Within the designated *Deepwater Horizon* spill area, more than 150 marine mammals were reported dead, with 13 stranded alive. Of the deceased marine mammals, 90 percent were bottlenose dolphins (USDOC, NMFS, 2015f). All marine mammals collected either alive or dead were found east of the Louisiana-Texas border through Apalachicola, Florida. The highest concentration of strandings occurred off eastern Louisiana, Mississippi, and Alabama with a significantly smaller number off western Louisiana and western Florida (USDOC, NMFS, 2012a). Recent tissue studies have been published on lung and adrenal lesions from bottlenose dolphins in Barataria Bay that were likely caused by petroleum contaminants (USDOC, NMFS, 2015f). However, it is also important to note that evaluations are still ongoing and it is possible that many or some carcasses were related to the *Deepwater Horizon* oil spill (USDOC, NMFS, 2015g).

5.3. ATLANTIC PROGRAM AREA

This section provides a regional summary description of marine mammals in the Atlantic Program Area (Figure 2.1-3 of the Programmatic EIS).

5.3.1. Marine Mammals

In the western North Atlantic Ocean, including the waters of the Atlantic Program Area, there are 38 species of marine mammals representing three taxonomic orders: Cetacea (baleen whales, toothed whales, dolphins, and porpoises), Sirenia (manatee), and Carnivora (true seals) (Waring et al., 2014).

5.3.1.1. Listed under the Endangered Species Act

Seven marine mammal species that occur in the Atlantic Program Area are federally listed endangered species (USDOC, NMFS, 2011e). These include five baleen whales (NARW, blue whale, fin whale, sei whale, and humpback whale), one toothed whale (sperm whale), and the Florida subspecies of the West Indian manatee (Waring et al., 2010; USDOC, NMFS, 2011e).

North Atlantic Right Whale (*Eubalaena glacialis*)

The NARW is a migratory species found in western North Atlantic waters between 20° and 60° N latitude. The NARW is considered one of the most critically endangered whales (Jefferson et al., 2008). It is listed as endangered under the ESA, and the Western Atlantic Stock is classified as strategic because the average annual human-related mortality and serious injury exceeds potential biological removal (Waring et al., 2013).

Waring et al. (2014) estimated the western NARW population size to be at least 465 individuals, based on a 2011 census of individual whales identified using photo identification techniques. This value is considered to be a minimum estimate. This count has no associated coefficient of variation. The NARW minimum number alive population index, calculated from the individual sightings database (as it existed on 25 October 2013 for the years 1990 to 2011) suggests a positive and slowly accelerating trend in population size with a geometric mean growth rate for the period of 2.8 percent (Waring et al., 2014). Continued threats to the NARW population include commercial fishing interactions, vessel strikes, underwater noise, habitat degradation, and predators (USDOC, NMFS, 2005; Waring et al., 2010).

In 1994, three critical habitats for the NARW were designated by NMFS along the U.S. Atlantic coast (**Figure C-38**) (59 FR 28805). These include Cape Cod Bay/Massachusetts Bay, Great South Channel, and selected areas off the southeastern U.S. In 2009, NMFS received a petition to expand the critical habitat, and the agency is continuing its ongoing rulemaking process. NMFS initially expected that a proposed critical habitat rule would be submitted for publication in the *Federal Register* in the second half of 2011 (75 FR 61690). In January 2016, NMFS published expansion of the critical habitat, to include the northeast feeding areas in the Gulf of Maine/Georges Bank region and the calving grounds from North Carolina to northern Florida (81 FR 4838).

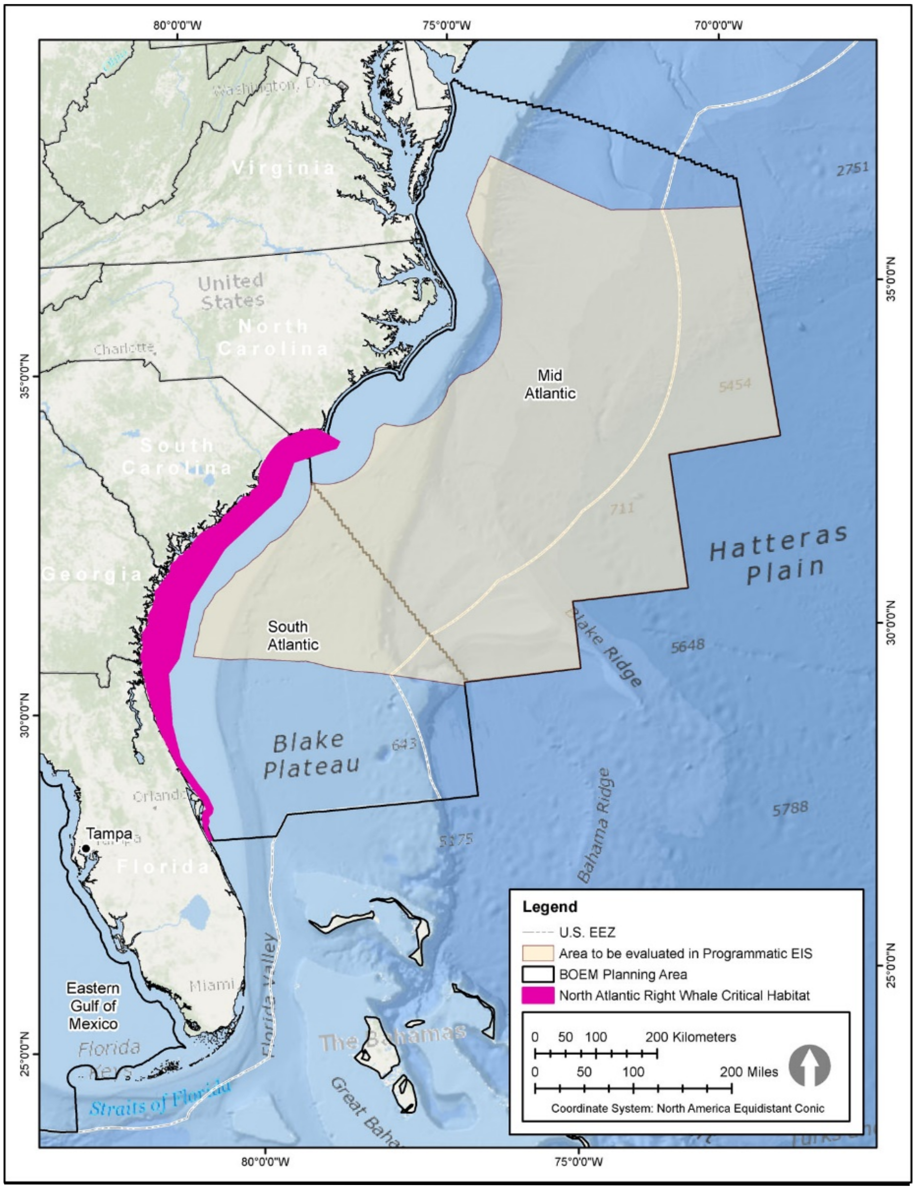


Figure C-38. Critical Habitat for the North Atlantic Right Whale.

Blue Whale (*Balaenoptera musculus*)

The blue whale is the largest cetacean, although its size range overlaps with that of fin and sei whales. The Northern Hemisphere subspecies (*B.m. musculus*) is known to occur within the Atlantic Program Area. According to the International Whaling Commission (2013), a full assessment of the present status of North Atlantic blue whales has not been carried out. At present, there are approximately 1,000 individuals off Iceland and several hundred in the Gulf of St Lawrence. They remain rare in the northeastern Atlantic where they were once common (International Whaling Commission, 2013). This blue whale stock is listed as strategic, because the species is listed as endangered under the ESA (Waring et al., 2010). There is no designated critical habitat for this species within the Atlantic Program Area.

The blue whale is considered by NMFS to be an occasional visitor in U.S. Atlantic EEZ waters, which may represent the current southern limit of its feeding range (Waring et al., 2010). Using Navy asset hydrophone arrays, Clark and Gagnon (2004) identified blue whales as far south as Bermuda, but rarely further south. In general, the range and seasonal distribution of blue whales are governed by the availability of prey (USDOC, NMFS, 1998a). Blue whales are usually observed alone or in pairs (Jefferson et al., 2008). Scattered aggregations may develop on prime feeding grounds. Their diet consists primarily of krill (euphausiids), and their depth distribution is usually associated with feeding (Sears, 2002).

Fin Whale (*Balaenoptera physalus*)

Fin whales off the eastern U.S. and eastern Canada are believed to constitute a single stock, the Western North Atlantic Stock (Waring et al., 2014), and are common in the U.S. Atlantic EEZ primarily from Cape Hatteras, North Carolina, northward (Waring et al., 2013). There is no designated critical habitat for the fin whale (USDOC, NMFS, 2010a).

The fin whale is found primarily within temperate and polar latitudes. Singing fin whales were found present in Bermuda from early September through mid-May (Clark and Gagnon, 2004). Fin whales were also seen in the mid-ocean near the Mid-Atlantic Ridge from late fall through early winter. Fin whales are observed singly or in groups of two to seven individuals. In the North Atlantic, fin whales often are seen in large mixed-species feeding aggregations including humpback whales, minke whales, and Atlantic white-sided dolphins (Jefferson et al., 2008). The best abundance estimate available for the fin whale in the Atlantic is 1,618 with a minimum population abundance of 1,234 (Waring et al., 2014).

Sei Whale (*Balaenoptera borealis*)

There are two classified sei whale stocks within the Atlantic: the Nova Scotia Stock and the Labrador Sea Stock. The range of the Nova Scotia Stock includes the continental shelf waters of the northeastern U.S. and extends northeastward to south of Newfoundland. There is no current population estimate of sei whales in the western North Atlantic Ocean, though survey data suggest that the Nova Scotia Stock size is approximately 357 individuals (Waring et al., 2013). There is no designated critical habitat for this species.

The sei whale is a cosmopolitan and highly migratory species (HMS) that is found from temperate to subpolar regions, but it appears to be more restricted to mid-latitude temperate zones than other rorquals (e.g., *Balaenoptera sp*., and humpback whales) (Reeves et al., 2002; Shirihai and Jarrett, 2006; Jefferson et al., 2008). Data suggest a major portion of the Nova Scotia Stock is centered in waters north of the Atlantic Program Area, at least during the feeding season (Waring et al., 2010). Within this range, the sei whale is often found near the continental shelf break. Sei whales are largely planktivorous, feeding primarily on euphausiids and copepods, but they will feed on small schooling fishes as well (Jefferson et al., 2008; Waring et al., 2010).

Humpback Whale (*Megaptera novaeangliae*)

Distinct geographic forms of humpback whales are not widely recognized, though genetic evidence suggests there are several subspecies (e.g., North Atlantic, Southern Hemisphere, and North Pacific) (USDOC, NMFS, 1991; Waring et al., 2014). In 2000, the NMFS Atlantic Stock Assessment Team reclassified the western North Atlantic humpback whale as a separate and discrete management stock (Gulf of Maine Stock) (Waring et al., 2014). NMFS recently estimated the humpback population in the western North Atlantic as 7,698 individuals (4,894 males and 2,804 females) (Waring et al., 2014). No critical habitat has been designated for the humpback whale.

Humpback whales are generally found within continental shelf areas and around oceanic islands. Most humpback whales in the western North Atlantic Ocean migrate to the West Indies to mate (e.g., Dominican Republic); however, some whales do not make the annual winter migration (Waring et al., 2014). Sightings show that humpback whales traverse coastal waters of the southeastern U.S., including those within the Atlantic Program Area (Waring et al., 2014). Swingle et al. (1993) and Barco et al. (2002) reported humpback sightings off Delaware Bay and Chesapeake Bay during the winter, which suggests the Mid-Atlantic region also may serve as wintering grounds for some Atlantic humpback whales. This region also may be an important area for juvenile humpbacks (Wiley et al., 1995).

Sperm Whale (*Physeter macrocephalus*)

Sperm whales within the northern Atlantic are classified in one stock (North Atlantic). It remains unresolved whether the northwestern Atlantic population is discrete from the northeastern Atlantic population (Waring et al., 2010). According to Waring et al. (2013), the current population estimate for the western North Atlantic (U.S. Atlantic coast) is 2,288 individuals, including 1,593 individuals in the northern U.S. Atlantic and 695 individuals in the southern U.S. Atlantic. There is no critical habitat for this stock (USDOC, NMFS, 2010b).

In waters of the U.S. Atlantic EEZ, sperm whale distribution appears to have a distinct seasonal cycle (Waring et al., 2010). In winter, sperm whales concentrate east and northeast of Cape Hatteras, North Carolina. In spring, distribution moves northward to waters east of Delaware and Virginia, but spreads throughout the central portion of the MAB to the southern portion of Georges Bank.

Sperm whales are usually found in medium to large “family unit” groups of 20 to 30 females and their young. Sperm whales feed primarily on cephalopods (squids and octopuses), and demersal and mesopelagic fishes (Whitehead, 2002; Jefferson et al., 2008; USDOC, NMFS, 2010b).

West Indian Manatee (Florida subspecies) (Trichechus manatus latirostris)

The Florida subspecies of the West Indian manatee is the only sirenian that occurs along the U.S. Atlantic coast. The majority of the Atlantic population of the Florida manatee is located in eastern Florida and southern Georgia (Waring et al., 2010), and is managed within four Florida distinct regional management units: Atlantic Coast (northeast Florida to the Florida Keys), Upper St. Johns River (St. Johns River, south of Palakta, Florida), Northwest (Florida Panhandle to Hernando County, Florida), and Southwest (Pasco County, Florida to Monroe County, Florida) (USDOI, USFWS, 2001, 2007). The Atlantic Coast Unit is the most relevant to the AOI; specifically, the South Atlantic Planning Area. Within the northwestern Atlantic, manatees occur in coastal marine, brackish, and freshwater areas from Florida to Virginia, with occasional extralimital sightings as far north as Rhode Island (Jefferson et al., 2008).

Critical habitat was designated for the Florida manatee on September 24, 1976 (41 FR 41914) and includes inland waterways in four northeastern Florida coastal counties (Brevard, Duval, St. Johns, and Nassau) that are not within the AOI.

5.3.1.2. Not Listed under the Endangered Species Act

There are 31 marine mammal species that may occur in Atlantic OCS waters that are not classified as endangered or threatened under the ESA, comprising 2 mysticetes, 26 odontocetes, and 4 pinnipeds (seals). Appropriate information relative to each species or species group is provided in **Table C-13**.

Table C-13. Information on Non-Listed Marine Mammal Species Occurring in the Atlantic.

Non-Listed Species	Distribution	Abundance Estimate	Abundance Estimate Minimum	Last Survey
Bryde's whale (*Balaenoptera brydei*)	• Distributed globally in tropical and subtropical waters (Omura, 1959; Kato, 2002) • Reported off the southeastern U.S. from Virginia to Florida, and through the southern West Indies to Cabo Frio, Brazil (Cummings, 1985; Waring et al., 2010)	N/A	N/A	N/A
Common minke whale (*Balaenoptera acutorostrata acutorostrata*)	• Cosmopolitan distribution, occurs in polar, temperate, and tropical waters • Found within waters of the continental shelf • Common within the U.S. Atlantic EEZ during summer months, largely absent during winter • Sightings suggest distribution is largely centered in New England and Canadian waters north of the Atlantic Program Area	2,591	N/A	2011
Beaked whales (*Mesoplodon)*: Blainville's beaked whale (*Mesoplodon densirostris*); Gervais' beaked whale (*Mesoplodon europaeus*); Sowerby's beaked whale (*Mesoplodon bidens*); True's beaked whale (*Mesoplodon mirus*); and	• *Mesoplodon* beaked whales are difficult to identify to the species level at sea (Waring et al., 2014) • Sighted along the continental shelf break in the mid-Atlantic region between Nova Scotia and central Florida, primarily in late spring and summer (Waring et al., 2010)	7,092	4,632	2011
Cuvier's beaked whale (*Ziphius cavirostris*).	• Sighted along the continental shelf edge in the mid-Atlantic region between Nova Scotia and central Florida, primarily in late spring and summer (Waring et al., 2013)	6,532	5,021	2011
Pantropical spotted dolphin (*Stenella attenuate*)	• Coastal and oceanic waters from 40° S to 40° N (Perrin and Gilpatrick, 1994; Perrin and Hohn, 1994) • Tropical and subtropical waters • Continental shelf edge and slope within habitat range	3,333	1,733	2011

Table C-13. Information on Non-Listed Marine Mammal Species Occurring in the Atlantic (Continued).

Non-Listed Species	Distribution	Abundance Estimate	Abundance Estimate Minimum	Last Survey
Striped dolphin (*Stenella coeruleolba*)	• Coastal and oceanic waters from 40° S to 40° N (Perrin and Gilpatrick, 1994; Perrin and Hohn, 1994) • Tropical to temperate waters • Continental shelf edge and slope within habitat range	54,807	42,804	2011
Clymene dolphin (*Stenella clymene*)	• Coastal and oceanic waters from 40° S to 40° N (Perrin and Gilpatrick, 1994; Perrin and Hohn, 1994) • Tropical and subtropical waters • Continental shelf edge and slope within habitat range	N/A	N/A	N/A
Atlantic spotted dolphin (*Stenella frontalis*)	• Coastal and oceanic waters from 40° S to 40° N (Perrin and Gilpatrick, 1994; Perrin and Hohn, 1994) • Tropical and subtropical waters • Occur on the continental shelf in some areas, including the Atlantic Program Area (Jefferson et al., 2008; Waring et al., 2010)	44,715	31,610	2011
Spinner dolphin (*Stenella longirostris*)	• Coastal and oceanic waters from 40° S to 40° N (Perrin and Gilpatrick, 1994; Perrin and Hohn, 1994) • Tropical and subtropical waters • Continental shelf edge and slope within habitat range	N/A	N/A	N/A
Pygmy sperm whale (*Kogia breviceps*) and Dwarf sperm whale (*Kogia sima*)	• Distributed worldwide in temperate to tropical waters (Caldwell and Caldwell, 1989; McAlpine, 2002) • Sightings occur in oceanic waters between Maine and central Florida (Waring et al., 2013)	3,785	2,598	2011

Table C-13. Information on Non-Listed Marine Mammal Species Occurring in the Atlantic (Continued).

Non-Listed Species	Distribution	Abundance Estimate	Abundance Estimate Minimum	Last Survey
Bottlenose dolphin (*Tursiops truncatus*)	• Based on genetic differences coastal form Bottlenose dolphins in the Program Area are divided into the following stocks: Western North Atlantic Northern Migratory Coastal Stock, Western North Atlantic Southern Migratory Coastal Stock, Western North Atlantic South Carolina/Georgia Coastal Stock, Western North Atlantic Northern Florida Coastal Stock, Western North Atlantic Central Florida Coastal Stock, Northern North Carolina Estuarine System Stock, Southern North Carolina Estuarine System Stock, Charleston Estuarine System Stock, Northern Georgia/Southern South Carolina Estuarine System Stock, Southern Georgia Estuarine System Stock, Jacksonville Estuarine System Stock, and Indian River Lagoon Estuarine System Stock. • Widely distributed throughout the western North Atlantic • The offshore form is distributed primarily along the OCS and continental slope in the northwest Atlantic Ocean from Nova Scotia to the southern Florida peninsula • The coastal form is continuously distributed along the Atlantic Coast from south of New York to around the Florida peninsula and may overlap with the offshore in the southeastern U.S.	Western North Atlantic Northern Migratory Coastal Stock: 11,548	Western North Atlantic Northern Migratory Coastal Stock: 8,620	Western North Atlantic Northern Migratory Coastal Stock: 2011
		Western North Atlantic Southern Migratory Coastal Stock: 9,173	Western North Atlantic Southern Migratory Coastal Stock: 6,326	Western North Atlantic Southern Migratory Coastal Stock: 2011
		Western North Atlantic South Carolina/Georgia Coastal Stock: 4,377	Western North Atlantic South Carolina/Georgia Coastal Stock: 3,097	Western North Atlantic South Carolina/Georgia Coastal Stock: 2011
		Western North Atlantic Northern Florida Coastal Stock: 1,219	Western North Atlantic Northern Florida Coastal Stock: 730	Western North Atlantic Northern Florida Coastal Stock: 2011
		Western North Atlantic Central Florida Coastal Stock: 4,895	Western North Atlantic Central Florida Coastal Stock: 2,851	Western North Atlantic Central Florida Coastal Stock: 2011
		Northern North Carolina Estuarine System Stock: 950	Northern North Carolina Estuarine System Stock: 785	Northern North Carolina Estuarine System Stock: 2006
		Southern North Carolina Estuarine System Stock: 188	Southern North Carolina Estuarine System Stock: 160	Southern North Carolina Estuarine System Stock: 2006
		Charleston Estuarine System Stock: 289	Charleston Estuarine System Stock: 281	Charleston Estuarine System Stock: 2006

Table C-13. Information on Non-Listed Marine Mammal Species Occurring in the Atlantic (Continued).

Non-Listed Species	Distribution	Abundance Estimate	Abundance Estimate Minimum	Last Survey
		Northern Georgia/Southern South Carolina Estuarine System Stock: N/A	Northern Georgia/Southern South Carolina Estuarine System Stock: N/A	Northern Georgia/Southern South Carolina Estuarine System Stock: N/A
		Southern Georgia Estuarine System Stock: 194	Southern Georgia Estuarine System Stock: 185	Southern Georgia Estuarine System Stock: 2009
Bottlenose dolphin (*Tursiops truncatus*) (cont.)		Jacksonville Estuarine System Stock: N/A	Jacksonville Estuarine System Stock: N/A	Jacksonville Estuarine System Stock: N/A
		Indian River Lagoon Estuarine System Stock: N/A	Indian River Lagoon Estuarine System Stock: N/A	Indian River Lagoon Estuarine System Stock: N/A
Killer whale (*Orcinus orca*)	• Distribution is cosmopolitan • Range extends from the Arctic ice-edge to the West Indies • Occurrence is unpredictable though they occur in the U.S. Atlantic EEZ fishing areas (Katona et al., 1988; Waring et al., 2014)	N/A	N/A	N/A
Pygmy killer whale (*Feresa attenuata*)	• Considered uncommon or rare in waters of the U.S. Atlantic EEZ (Waring et al., 2010)	N/A	N/A	N/A
False killer whale (*Pseudorca crassidens*)	• Distributed worldwide in tropical to subtropical waters (Jefferson et al., 2008)	442	212	2011
Risso's dolphin (*Grampus griseus*)	• Widely distributed in tropical and temperate seas • Occur from Florida to eastern Newfoundland (Leatherwood et al., 1976; Baird and Stacey, 1990) • Occur along the continental shelf edge from Cape Hatteras to Georges Bank, including in the Cape Hatteras Special Research Area (CHSRA) during spring, summer, and autumn	18,250	12,619	2011
Long-finned pilot whale (*Globicephala melas*)	• Occur in oceanic waters in the U.S. Atlantic EEZ • Occur in temperate and subpolar waters, with some distributional overlap with short-finned pilot whales in their southern range, including the CHSRA • Reported stranded as far south as Florida	26,535	19,930	2006

Table C-13. Information on Non-Listed Marine Mammal Species Occurring in the Atlantic (Continued).

Non-Listed Species	Distribution	Abundance Estimate	Abundance Estimate Minimum	Last Survey
Short-finned pilot whale *(Globicephala macrorhynchus)*	• Occur in oceanic waters in the U.S. Atlantic EEZ • Occur in warm temperate to tropical waters and, within the North Atlantic, generally do not range farther north than 50° N latitude • Majority of reported strandings occurred from North Carolina southward	21,515	15,913	2011
Short-beaked common dolphin (*Delphinus delphis*)	• Distributed in waters off the northeastern U.S. coast (Cetacean and Turtle Assessment Program [CETAP], 1982; Selzer and Payne, 1988; Waring et al., 1992; Hamazaki, 2002) • Regularly occur along the continental shelf and slope (100 to 2,000 m [328 to 6,562 ft]) from 50° N to Cape Hatteras, North Carolina	70,184	N/A	2011
Melon-headed whale (*Peponocephala electra*)	• Distributed worldwide in tropical to subtropical waters (Jefferson et al., 2008) • Rare sightings perhaps because of a naturally low number of groups compared to other cetacean species	N/A	N/A	N/A
Atlantic white-sided dolphin (*Lagenorhynchus acutus*)	• Found in cold temperate and subpolar waters of the North Atlantic (Cipriano, 2002) • Preferred habitat appears to be waters of the outer continental shelf and slope; although there are regular sightings within the western North Atlantic waters along the mid-shelf to the 100-m (328-ft) depth contour (Waring et al., 2010)	48,819	30,401	2011
Fraser’s dolphin (*Lagenodelphis hosei*)	• Distributed within tropical, oceanic waters between 30° N and 30° S • Occur closer to shore in areas where deep water approaches the coast (Dolar, 2002; Jefferson et al., 2008)	N/A	N/A	N/A
Rough-toothed dolphin (*Steno bredanensis*)	• Distributed within tropical and subtropical waters between 40° N and 35° S • Inhabit deep, oceanic waters • Records from the Atlantic are mostly from between the southeastern U.S. and southern Brazil (Jefferson, 2002)	271	134	2011

Table C-13. Information on Non-Listed Marine Mammal Species Occurring in the Atlantic (Continued).

Non-Listed Species	Distribution	Abundance Estimate	Abundance Estimate Minimum	Last Survey
Gray seal (*Halichoerus grypus*)	• Ranges from Canada to New York • Strandings record them as far south as Cape Hatteras (Davies, 1957; Mansfield, 1966; Katona et al., 1993; Lesage and Hammill, 2001) • Recorded strandings were highest of the four species in the Mid- and South Atlantic Planning Areas between 2007 and 2011, with 205 records on coastlines between Delaware and Virginia (NOAA Northeast Stranding Network, unpublished pinniped stranding records for New Jersey, Delaware, Maryland, and Virginia, 2007-2011)	N/A	N/A	N/A
Harbor seal (*Phoca vitulina*)	• Found in all nearshore waters of the Atlantic Ocean and adjoining seas north of 30ºN (Katona et al., 1993) • In the western North Atlantic distributed from eastern Canada to southern New England and New York, and occasionally to the Carolinas (Mansfield, 1967; Boulva and McLaren, 1979; Katona et al., 1993; Gilbert and Guldager, 1998; Baird, 2001) • Within the Atlantic Program Area between Delaware and Virginia, there were 161 harbor seal strandings between 2007 and 2011 (NOAA Northeast Stranding Network, unpublished pinniped stranding records for New Jersey, Delaware, Maryland, and Virginia, 2007-2011)	70,142	48,980	2012
Harp seal (*Phoca groenlandica*)	• Occurs throughout much of the North Atlantic and Arctic Oceans (Ronald and Healey, 1981) • Highly migratory (Sergeant, 1965; Stenson and Sjare, 1997) • Within the Atlantic Program Area between Delaware and Virginia, there were 180 harp seal strandings between 2007 and 2011 (NOAA Northeast Stranding Network, unpublished pinniped stranding records for New Jersey, Delaware, Maryland, and Virginia, 2007-2011)	N/A	N/A	N/A

Table C-13. Information on Non-Listed Marine Mammal Species Occurring in the Atlantic (Continued).

Non-Listed Species	Distribution	Abundance Estimate	Abundance Estimate Minimum	Last Survey
Hooded seal (*Cystophora cristata*)	• Throughout much of the North Atlantic and Arctic Oceans (King, 1983) • Prefer deeper water and occurs farther offshore than harbor seals (Sergeant, 1976; Campbell, 1987; Lavigne and Kovacs, 1988; Stenson et al., 1996) • Increased occurrences of hooded seals from Maine to Florida in summer and autumn (McAlpine et al., 1999; Harris et al., 2001; Mignucci-Giannoni and Odell, 2001) • Only five recorded strandings of hooded seals within the Atlantic Program Area between Delaware and Virginia between 2007 and 2011 (NOAA Northeast Stranding Network, unpublished pinniped stranding records for New Jersey, Delaware, Maryland, and Virginia, 2007-2011)	N/A	N/A	N/A

Abundance data from Waring et al. (2014), or Waring et al. (2013) when the information was not provided in Waring et al. (2014).
N/A = not available.

5.3.1.3. Unusual Mortality Event for Cetaceans in the Atlantic

As of April 5, 2015, NMFS declared a UME for bottlenose dolphin in the mid-Atlantic. Since July 2013 from New York to Brevard County in Florida there has been an elevated number of bottlenose dolphin strandings (USDOC, NMFS, 2013a). From July 1, 2013 to April 5, 2015 a total of 1,660 bottlenose dolphins have stranded. Preliminary evidence shows increased strandings could be related to a cetacean morbillivirus. As of December 22, 2014, 270 cases of the morbillivirus have been diagnosed or are suspected positive from stranded cetaceans sampled in 9 Atlantic states (USDOC, NMFS, 2013b).

From January 2013 to present, a UME has been declared for the bottlenose dolphin population in the Indian River Lagoon System off of Florida's Atlantic coast. Elevated strandings have been documented, with a main necropsy finding of emaciation (USDOC, NMFS, 2015g).

In April 2013, NMFS declared a UME for the manatee in Brevard County, Florida. From July 2012 to March 2014, 130 manatee deaths were documented (FWC, 2015; USDOC, NMFS, 2015g). The cause is still undetermined.

6.0. SEA TURTLES

All sea turtles are protected under the ESA. The hawksbill (*Eretmochelys imbricata*), Kemp's ridley (*Lepidochelys kempii*), and leatherback (*Dermochelys coriacea*) turtles are listed under the ESA as endangered. The green turtle (*Chelonia mydas*) is listed as threatened, except for the Florida breeding population, which is endangered (USDOC, NMFS, 2011g). The Northwest Atlantic population of the loggerhead turtle currently is classified as threatened (79 FR 39856; USDOC, NMFS, 2011h). Because sea turtles use terrestrial and marine environments at different life stages, USFWS and NMFS share jurisdiction over sea turtles under the ESA. The USFWS has jurisdiction over nesting beaches, and NMFS has jurisdiction in the marine environment.

Nesting beaches within the Gulf of Mexico and Atlantic Program Areas are subject to periodic impacts from tropical cyclones, including hurricanes and tropical storms. Studies suggest that tropical cyclones are a significant factor in sea turtle nesting declines (van Houtan and Bass, 2007). Generally, storm-induced impacts to nesting beaches include beach flooding and the displacement of large volumes of sand (Pike and Stiner, 2007). Sea turtle eggs lose and gain water quickly depending on nest conditions, and eggs in nests exposed to seawater may be lost either because of inhibited oxygen exchange or due to rapid water loss to saline seawater (Packard, 1999). Displacement of sand during storm events may expose and destroy established nests or may alter beach morphology so that it is not suitable for nesting habitat. Factors that may affect nesting success during storm season include the distance of the nest from shore, the nest depth, and nesting season.

6.1. GULF OF MEXICO PROGRAM AREA

Five species of sea turtles occur in all three Gulf of Mexico Planning Areas. These are the green, hawksbill, Kemp's ridley, leatherback, and loggerhead turtles. All swim and use coastal beaches within the Gulf of Mexico Planning Areas. Kemp's Ridley and loggerhead turtles nest on beaches. Currently, only the loggerhead has a designated critical habitat within or adjacent to the Gulf of Mexico Program Area (**Figure C-39**).

Important marine habitats for sea turtles in and adjacent to the Gulf of Mexico Program Area include nesting beaches, estuaries and embayments, and nearshore hard substrate areas. Nesting occurs on sandy beaches from Texas to Florida.

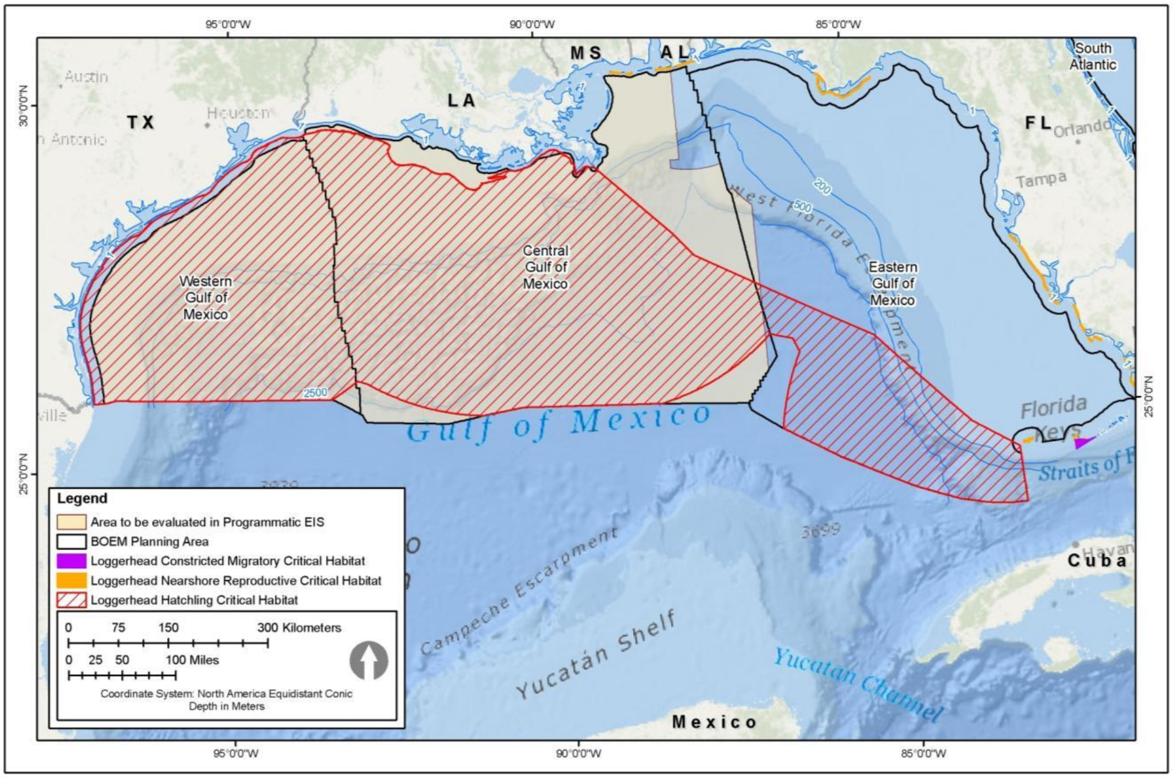


Figure C-39. Critical Habitat for Loggerhead in the Gulf of Mexico.

Most sea turtles exhibit different habitat distributions during their various life stages of hatchling, juvenile, and adult (Marquez, 1990; Hirth, 1997; Musick and Limpus, 1997). Early juvenile sea turtles are found in a pelagic or oceanic nursery habitat. Migratory behavior of adult sea turtles is much better understood than that of hatchlings and juveniles, because they have been tracked using satellite telemetry. Many females have been tracked after nesting. Hatchling sea turtles may be found within zones of water mass convergence and/or *Sargassum* rafts, which are rich in prey and provide shelter (USDOC, NMFS and USDOI, USFWS, 2008; Hirth, 1997). These hatchlings may have originated at nesting sites along Gulf of Mexico shores, or adjacent areas such as the Caribbean Sea.

Loggerhead Turtle (*Caretta caretta*)

Loggerhead turtles are the most common sea turtle species in the Gulf of Mexico Program Area. In the Gulf of Mexico, loggerhead turtles nest primarily in southwest Florida with minimal nesting outside this area westward to Texas. Estimating sea turtle populations is challenging, and generally the status of the population is assessed based on the number of annual nests at different locations within a region, anthropogenic threats, and estimates of mortality (Conant et al., 2009).

Overall, the total number of nests per year in the U.S. over the last two decades have been estimated to range from 47,000 to 90,000 (USDOI, USFWS, 2015). The Northern Gulf of Mexico Recovery Unit found an average 906 nests per year from 1995 through 2007, with a log regression of data from a Florida nesting index survey showing a declining trend of 42 percent annually (USDOC, NMFS and USDOI, USFWS, 2008).

On July 10, 2014, the critical habitat for nesting beaches for the Northwest Atlantic DPS of loggerhead turtles in coastal areas of the Gulf of Mexico (and other locations outside the Program Area) was accepted (**Figure C-39**) (79 FR 39755). The critical habitat originally was proposed by the USFWS and NOAA.

Green Turtle (*Chelonia mydas*)

Green turtles are found throughout the Gulf of Mexico, but nest in very small numbers on Gulf of Mexico beaches (USDOC, NMFS and USDOI, USFWS, 2007a). Green turtles are vulnerable to cold temperatures, so in many locations they are found only seasonally within the Gulf of Mexico Program Area (Foley et al., 2007). Green turtles nest infrequently along the Gulf of Mexico coast, with the most important nesting sites outside of the Program Area along the Atlantic coast of Florida (USDOC, NMFS and USDOI, USFWS, 2007a). The green turtle population is considered severely depleted in comparison to its estimated historical levels (USDOC, NMFS and USDOI, USFWS, 2007a). Currently, there is no reliable green turtle population estimate.

Hawksbill Turtle (*Eretmochelys imbricata*)

In the western North Atlantic, hawksbill sea turtles are widely distributed throughout the Caribbean Sea and occur regularly in southern Florida, the Gulf of Mexico, the Greater and Lesser Antilles, and along the Central American mainland south to Brazil. However, hawksbill turtle nesting on Gulf of Mexico beaches is extremely rare; one nest was documented at Padre Island in 1998 (Mays and Shaver, 1998). Hawksbill turtles use a wide range of habitats during their lifetimes but prefer to forage at coral reefs habitats, which are found in only a few isolated locations in the Gulf of Mexico Program Area. The hawksbill turtle population is severely depleted and continues to be threatened (Bjorndal, 1999). There are no nesting estimates for hawksbill turtles within the Gulf of Mexico Program Area, but the number of nesting females per season in the Caribbean ranges from 5 to 18 in Bonaire, and 400 to 833 in Cuba (USDOC, NMFS and USDOI, USFWS, 2013).

Kemp's Ridley Turtle (*Lepidochelys kempii*)

The Kemp's ridley turtle is found mainly in the Gulf of Mexico but is occasionally sighted along the Atlantic coast from Florida to New England (USDOC, NMFS et al., 2010). Primary habitat for adult sea turtles is nearshore waters of <37 m (121 ft). However, it is not uncommon for adults to swim further from shore where waters are deeper (USDOC, NMFS and USDOI, USFWS, 2007b). Survey data from the Gulf of Mexico suggest that Kemp's ridley turtles occur mainly in waters over the continental shelf.

Juvenile and adult Kemp's ridleys typically are found in shallow areas and especially in areas of seagrass habitat (Marquez, 1990; Ernst et al., 1994; USDOC, NMFS et al., 2010). In the Gulf of Mexico, shallow coastal habitats serve as foraging grounds for Kemp's ridley turtles throughout the year, although there is evidence for seasonal offshore movements in response to low water temperatures in the winter (Bjorndal, 1997). Females have been tracked to foraging areas from the Yucatan Peninsula to southwest Florida (USDOC, NMFS and USDOI, USFWS, 2007b). Key foraging areas within the Program Area include Sabine Pass, Texas; Caillou Bay and Calcasiu Pass, Louisiana; Bug Gulley, Alabama; Cedar Keys, Florida; and Ten Thousand Islands, Florida (USDOC, NMFS and USDOI, USFWS, 2007b). The Kemp's ridley turtle population is severely depleted, and it is considered the most endangered sea turtle (USDOI, USFWS, 1999).

On February 17, 2010, the USFWS and NMFS were jointly petitioned to designate critical habitat for Kemp's ridley turtles for nesting beaches along the Texas coast and marine habitats in the Gulf of Mexico and Atlantic Ocean (WildEarth Guardians, 2010).

Leatherback Turtle (*Dermochelys coriacea*)

The leatherback turtle is a cosmopolitan species that is found in the Mediterranean Sea and Indian, Pacific, and Atlantic Oceans, including the Gulf of Mexico; it is reported to have the widest distribution of any sea turtle (USDOC, NMFS and USDOI, USFWS, 2013b). The leatherback turtle is the most abundant sea turtle in waters over the northern Gulf of Mexico continental slope (Mullin and Hoggard, 2000), but nesting on Gulf of Mexico beaches is rare. Leatherbacks appear to use both continental shelf and slope waters in the Gulf of Mexico (Fritts et al., 1983a, b; Collard, 1990; Davis and Fargion, 1996).

GulfCet I and II surveys suggest that the region from Mississippi Canyon to DeSoto Canyon, especially near the shelf edge, appears to be an important habitat for leatherbacks (Mullin and Hoggard, 2000). The most recent population estimate for adult leatherback turtles in the Atlantic including the western Caribbean is between 34,000 and 94,000 but appears stable (USDOC, NMFS and USDOI, USFWS, 2013b). Leatherback turtles are highly migratory (Shillinger et al., 2008).

6.2. ATLANTIC PROGRAM AREA

Five sea turtle species occur in the Atlantic Program Area (Figure 2.1-3 of the Programmatic EIS). Loggerhead, leatherback, and green turtles are more commonly found within the Atlantic Program Area during nesting season and as a function of life stages. Green, leatherback, and loggerhead turtles use coastal beaches within the Program Area as primary nesting sites, with the main nesting beaches in southeast Florida. However, loggerhead turtles also nest along the southeast coast as far north as Virginia. Kemp’s ridley and particularly hawksbill turtles are less common. The USFWS and NMFS have designated critical habitat for the loggerhead, green, hawksbill, and leatherback turtles. The loggerhead critical habitat is within or adjacent to the Atlantic Program Area (**Figure C-40**). Important marine habitats for sea turtles in and near the Atlantic Program Area include nesting beaches, estuaries and embayments, nearshore hard substrate areas, and the Gulf Stream. Within the Atlantic Program Area, sea turtle nesting occurs on sandy beaches from Virginia to Florida. Most sea turtle species move geographically, either seasonally or between nesting activities. Some species may move seasonally into foraging habitats through migration corridors and to nesting beaches (Mansfield et al., 2009; Hawkes et al., 2011). The size of “resident” foraging habitats appears to vary with species and location. Studies suggest that resident foraging area size in the western North Atlantic decreases from north to south, possibly because of available food resources and the width of the continental shelf, which also decreases from north to south (Griffin, 2002).

Embayments such as Chesapeake Bay and Delaware Bay provide important foraging and developmental habitat for sea turtles (Musick, 1988; Coles, 1999; Spotila et al., 2000). Exposed hard substrate in shallow nearshore areas off eastern Florida does as well, particularly for juveniles and subadults (Continental Shelf Associates, 2009). Sea turtles use the Gulf Stream for various purposes such as migration (Hoffman and Fritts, 1982). *Sargassum* mats that form in convergence zones associated with the Gulf Stream provide shelter and foraging habitat for hatchling and post-hatchling sea turtles (Carr and Meylan, 1980; South Atlantic Fishery Management Council [SAFMC], 2002).

Loggerhead Turtle (*Caretta caretta*)

The southeast U.S. coast is among the most important areas in the world for loggerhead nesting. NMFS and USFWS (2008) reported that approximately 80 percent of loggerhead nesting in this region occurs in six Florida counties: Brevard, Indian River, St. Lucie, Martin, Palm Beach, and Broward. Brevard County is located within the Atlantic Program Area, while Indian River, St. Lucie, Martin, Palm Beach, and Broward Counties are south of the Atlantic Program Area. Other important nesting locations occur in South Carolina (6.5 percent), Georgia (1.5 percent), North Carolina (1 percent), and Virginia (<1 percent), but not at the same magnitude as in Florida (USDOC, NMFS and USDOI, USFWS, 2008).

On July 10, 2014, the critical habitat for nesting beaches for the Northwest Atlantic DPS of loggerhead turtle was accepted (**Figure C-40**) (79 FR 39755). These include coastal areas of North Carolina, South Carolina, Georgia, and the Atlantic coast of Florida as well as areas in the Gulf of Mexico. The critical habitat was originally proposed by the USFWS and NOAA.

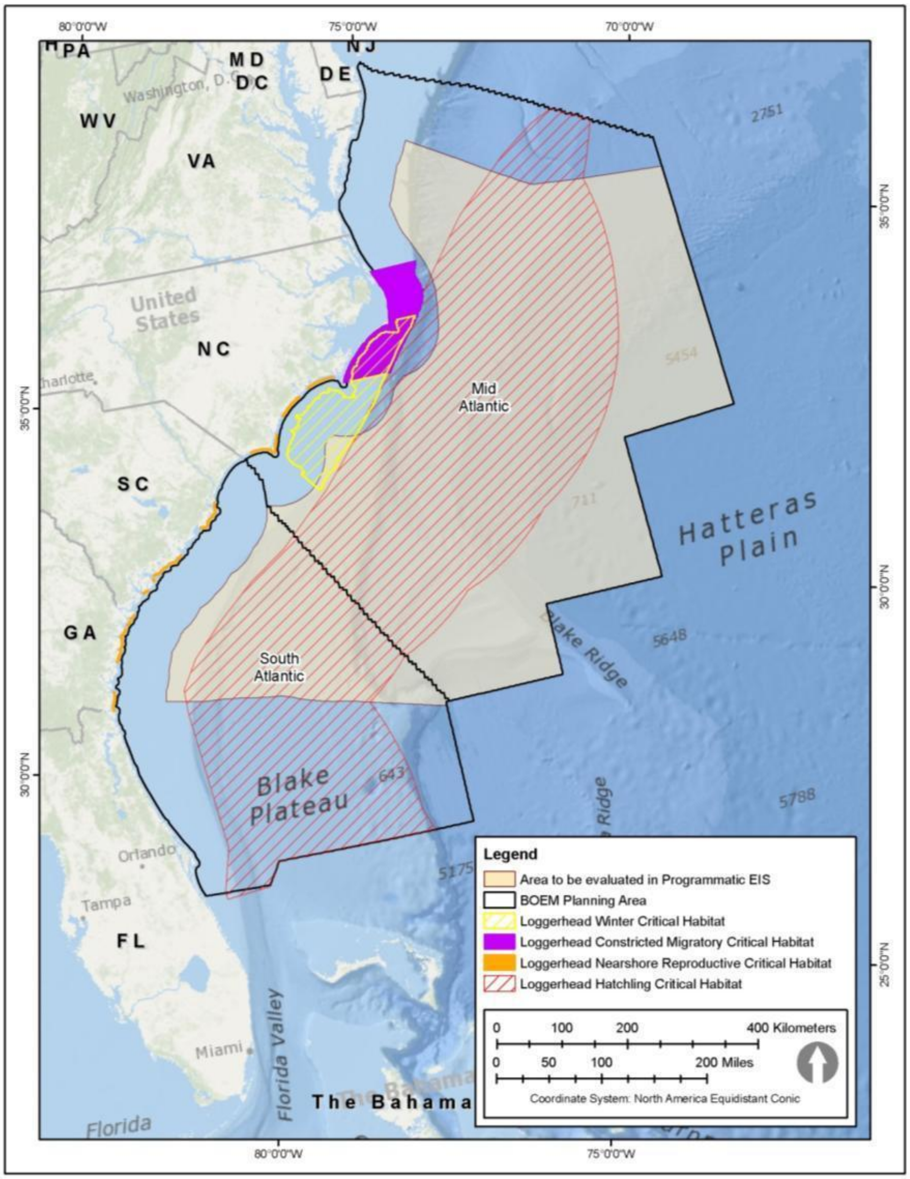


Figure C-40. Critical Habitat for Loggerhead in the Atlantic.

Green Turtle (*Chelonia mydas*)

The green turtle is the largest cheloniid sea turtle; adults can attain carapace lengths to 0.91 m (3 ft), and range in mass between 136 and 159 kg (300 and 350 lb). In the western North Atlantic, green sea turtles can be found on various coastal beaches during the nesting season and at other times feeding or swimming in nearshore or offshore waters from Florida to Massachusetts (USDOC, NMFS and USDOI, USFWS, 2007a). Green turtles are vulnerable to cold temperatures, so in many locations they are found only seasonally within the Atlantic Program Area (Foley et al., 2007). Based on satellite tagging research by Hart and Fujisaki (2010), green turtles display daily and seasonal movement patterns that are associated with foraging strategies. The researchers indicated that locations with optimal habitats (e.g., sources of marine algae) are likely locations where small juvenile green turtles may be found. Based on this study, it is probable that juvenile green turtles may be found in various shallow-water inshore areas in the Atlantic Program Area where seagrass is reported.

The green turtle population is considered severely depleted in comparison to its estimated historical levels (USDOC, NMFS and USDOI, USFWS, 2007a). Currently, there is no reliable green turtle population estimate, but inferences have been attempted using nesting data. The recent 5-year status review (USDOC, NOAA, 2015) reported that the total mean annual green turtle nesting abundance was approximately 8,426 nests on the Florida Atlantic coast during 2001 through 2012, and the number of nests appears to be increasing.

In 1998, NMFS designated critical habitat for the green turtle as the waters of Culebra Island, Puerto Rico, and its outlying keys (63 FR 170). Under the designation process, NMFS identified critical habitat for green turtles as specific geographic areas that have those physical or biological features essential to the conservation of the green turtle that may require special management considerations. In March 2015, NMFS proposed to remove the current range-wide listing of the green turtle and to list 8 DPSs (Central North Pacific, East Indian-West Pacific, East Pacific, North Atlantic, North Indian, South Atlantic, Southwest Indian, and Southwest Pacific) as threatened and 3 DPSs (Central South Pacific, Central West Pacific, and Mediterranean) as endangered (80 FR 15271).

Hawksbill Turtle (*Eretmochelys imbricata*)

The hawksbill turtle is a medium-size cheloniid sea turtle; adults can attain carapace lengths of 1.1 m (3.5 ft) and masses of 82 kg (180 lb) (USDOC, NMFS and USDOI, USFWS, 2007b). In the western North Atlantic, hawksbill turtles can be found from Florida to Massachusetts, but they are rarely reported north of Florida or within the Atlantic Program Area. In comparison to the other sea turtles potentially found within the region, the hawksbill turtle has a restricted distribution and range, given that its preferred foraging habitat is coral reefs, which are found only in Atlantic near-coastal areas south of the Atlantic Program Area.

Juvenile hawksbill turtles have been reported to use offshore floating mats of *Sargassum* as habitat, so it is possible that they are found in the offshore parts of the Atlantic Program Area that are associated with the Gulf Stream (USDOC, NMFS and USDOI, USFWS, 1993); the Gulf Stream often transports large patches of *Sargassum*. In addition to offshore and reef habitats, hawksbill turtles also are known to use mangrove-fringed bays, estuaries (Carr, 1952), and Caribbean seagrass habitats (Bjorndal and Bolten, 1988, 2010).

The hawksbill turtle population is severely depleted and continues to be threatened (Bjorndal, 1999). Although there is no reliable hawksbill turtle population estimate, conclusions have been made from nesting data. The recent 5-yr status review reported that the number of hawksbill turtles nesting in the western North Atlantic has decreased over the last 20 yr (USDOC, NMFS and USDOI, USFWS, 2007b). However, nesting populations of hawksbill turtles in this region are much larger than in some other regions (e.g., Indo-Pacific Ocean), where populations continue to decline. There are no nesting estimates for hawksbill turtles within the Atlantic Program Area.

Critical habitat for the hawksbill turtle was originally designated in 1982 and subsequently in 1998 (63 FR 46693). Critical habitat for the hawksbill turtle includes Mona, Culebrita, and Culebra Islands in Puerto Rico, and the waters 3 to 5 km (1.9 to 3.1 mi) from the islands of Mona and Monito. Critical habitat also includes specific beaches on Culebra Island, including Playa Resaca, Playa Brava, and Playa Larga.

Kemp's Ridley Turtle (*Lepidochelys kempii*)

The Kemp's ridley is the smallest sea turtle; adults reach only 76 cm (30 in) in carapace length and range in mass from 36 to 45 kg (80 to 100 lb). The Kemp's ridley turtle is occasionally sighted along the Atlantic coast from Florida to New England and there is some evidence that they nest on beaches within the Atlantic Program Area (USDOC, NMFS et al., 2010). However, this is considered rare. Johnson et al. (1999) reported that Kemp's ridley turtles nest on the beaches of North Carolina, South Carolina, and Florida (Ponce Inlet and New Smyrna Beach, Volusia County); all of these locales are adjacent to the

Atlantic Program Area. Johnson et al. (1999) also reported Kemp's ridley turtles nesting in Palm Beach County, Florida, south of the Atlantic Program Area.

The Kemp's ridley turtle population is severely depleted, and it is considered the most endangered sea turtle (USDOI, USFWS, 1999). Currently, the population is stressed and there are no reliable estimates of the Kemp's ridley turtle population. Given that most of the Kemp's ridley turtle population nests in one U.S. location (South Texas coast), better population estimates have been inferred from nesting data (USDOI, USFWS, 1999). Using various assumptions, the current population estimate for Kemp's ridley turtles is approximately 738 females, but the number of nesting Kemp's ridley turtles continues to improve. Márquez (2001) indicated that the annual number of nests in Tamaulipas, Mexico, has increased between 8 and 12 percent since 1988. NMFS et al. (2010) reported that the number of nests per season in Rancho Nuevo, Mexico, recently exceeded 20,000 and stated that the nesting population is growing exponentially.

Leatherback Turtle (*Dermochelys coriacea*)

The leatherback turtle is the largest sea turtle; adults attain carapace lengths up to 1.8 m (6 ft) and weights of 907 kg (2,000 lb). In the Atlantic Ocean, the leatherback turtle is reported throughout the North Sea, Canadian waters, and along the Atlantic coast of the U.S. and into the Gulf of Mexico and Caribbean Sea. Leatherback turtles are found throughout the Atlantic Program Area, depending on season. In Virginia, Coles (1999) reported from sea turtle stranding data that leatherback turtles frequently were sighted and stranded in Chesapeake Bay from 1979 through 1997. Off South Carolina, leatherback turtles primarily are observed between April and June when cannonball jellyfish (*Stomolophus meleagris*) are abundant, and again in October and November (South Carolina Department of Natural Resources [SCDNR], 2005b). Along the U.S. Atlantic coast, the principal nesting beaches for leatherback turtles are in Florida. According to the SCDNR (2005b), leatherback turtles also nest in Georgia, South Carolina (with four leatherback nests since 1996), North Carolina, and possibly in Maryland.

Similar to other sea turtles, the leatherback population also is depleted; however, in comparison to other sea turtles, the population is more stable (USDOC, NMFS and USDOI, USFWS, 2007c). The most recent population estimate for leatherback turtles in the Atlantic ranges 34,000 to 94,000 and appears to be stable (USDOC, NMFS and USDOI, USFWS, 2007c).

Critical habitat initially was designated for the leatherback turtle in 1979 (44 FR 58). Critical habitat was defined as specific areas in the U.S. Virgin Islands: a strip of land 0.2-mi (0.3-km) wide at Sandy Point Beach, St. Croix, and in the waters adjacent to the site from the shore to the 100-fathom depth contour. In February 2010, NMFS and the USFWS were petitioned to revise critical habitat to include the offshore waters to allow for safe and timely passage and access to, from, and within nesting sites at San Miguel, Paulinas, and Convento Beaches in the Northeast Ecological Corridor of Puerto Rico, and to protect reproductive activities offshore of these sites (Sierra Club, 2010). In July 2010, NMFS concluded that the petition did not warrant revision of the critical habitat (75 FR 41436).

7.0. MARINE AND COASTAL BIRDS

7.1. ALASKA PROGRAM AREA

This section discusses the birds that utilize coastal and marine habitats during breeding, feeding and wintering that could be affected by spills within the Alaska Program Area (Figure 2.1-1 in the Programmatic EIS). The discussion in this section includes a general overview of the groups of coastal and marine birds, federally listed and candidate species, migratory birds, and Important Bird Areas (IBAs) with ranges within the Program Area.

7.1.1. Beaufort Sea and Chukchi Sea Planning Areas

Because of the limited seasonal nature of open water and snow-free conditions, the Beaufort and Chukchi Seas support a relatively small number of avian species. For example, approximately 180 species have been reported as located inland, across all seasons from the Arctic NWR (USDOI, USFWS, 2010), while a 1999–2001 summer survey of birds in the western Beaufort Sea detected 30 species that primarily were waterfowl (Fischer and Larned, 2004). Most birds occurring in the Beaufort and Chukchi Seas and their adjacent coastal habitats are migratory, being present for all or part of the period between May and early November. The avian fauna of these regions largely falls into two categories: (1) birds that arrive in spring at coastal breeding areas, breed and raise young, and then depart in fall to southern wintering areas; and (2) birds that molt and migrate along the coast on their way to and from breeding areas elsewhere on the Arctic coast. Some groups such as the passerines, have low species numbers in coastal habitats along the Arctic coast. Several species of passerines regularly occur on migration flights above coastal and pelagic waters of the Beaufort and Chukchi Seas, and on barrier island stopovers, but migration routes and status beyond the uncommon vagrant is not well-known. A majority of species nesting in coastal areas are waterfowl and shorebirds, although in some locations seabirds occur in large nesting colonies.

Coastal and marine birds occurring within and adjacent to the Beaufort and Chukchi Seas Planning Areas encompass dozens of species which fall into at least 7 orders and 10 taxonomic families and include seabirds, waterfowl, shorebirds, wading birds, and raptors (**Table C-14**). In addition, various other species may fly over the area during migration or use adjacent terrestrial habitats during the course of the year, although with few exceptions, most passerines are considered to be rare or casual visitors to the North Slope coast (USDOI, USFWS, 2010d). Bird species within a family share common physical and behavioral characteristics. Because of these commonalities, in **Table C-14**, birds will be presented by taxonomic families rather than as individual species.

Table C-14. Groups of Coastal and Marine Birds Occurring in and Adjacent to the Beaufort and Chukchi Seas Planning Areas.

Common Names of Representative Taxa	Description
Jaegers	Pelagic, gull-like birds, coming to land only to nest. Found in Beaufort Sea and Chukchi Sea Planning Areas during summer and during migration.
Gulls and terns	Gregarious. Nest colonially on islands and rocky coasts in Beaufort Sea and Chukchi Sea Planning Areas; found in area year-round. Gulls omnivorous and opportunistic; terns plunge-dive for small prey from water surface.
Murres, murrelets, guillemots, auklets and puffins	Pelagic, coming to land only to nest colonially. Dive for fish and crustaceans; ungainly on land. Nest colonially on islands and coastal slopes in Beaufort Sea and Chukchi Sea Planning Areas; some species, including black guillemot (*Cepphus grylle*), pigeon guillemot (*C. columba*), and common murre (*Uria aalge*) may remain in areas of open water through the winter (Audubon, 2015; Cornell University, 2015).
Plovers	Small shorebirds which nest singly on beaches and dunes in Beaufort Sea and Chukchi Sea Planning Areas. Pick small prey from intertidal zone. Found in Beaufort Sea and Chukchi Sea Planning Areas in summer and during migration.
Sandpipers, turnstones, godwits, curlews, and phalaropes	A diverse family of shorebirds which use a variety of habitats including beaches, dunes, mudflats, salt marshes, and rocky coasts. Short-billed species pick prey from ground or water, while larger-billed species probe into mud or sand. Many species pass through during migration and a few breed in Beaufort Sea and Chukchi Sea Planning Areas. Rock sandpiper remains through the winter.
Loons	Large waterbirds that dive for fish. Leave water only to nest. Present in Beaufort Sea and Chukchi Sea Planning Areas year-round but mainly on freshwater in summer. Can form large groups in coastal bays and nearshore waters of Beaufort Sea and Chukchi Sea Planning Areas.

Table C-14. Groups of Coastal and Marine Birds Occurring in and Adjacent to the Beaufort and Chukchi Seas Planning Areas (Continued).

Common Names of Representative Taxa	Description
Cormorants	Waterbirds that sit and swim on the water and dive for fish. Nest colonially in Beaufort Sea and Chukchi Sea Planning Areas; found there year-round.
Fulmars, petrels, and shearwaters	Highly pelagic and aerial species, coming to land only to nest. Found year-round in Beaufort Sea and Chukchi Sea Planning Areas. Feed from water surface or using shallow dives.
Ducks, mergansers, geese, and swans	A large and diverse family which uses a variety of habitats including barrier islands, coastal ponds, bays, salt marshes, rivers, and open ocean. Species feed either by dabbling or diving; some have specialized diets. Found in Beaufort Sea and Chukchi Sea Planning Areas year-round.
Falcons	Feed primarily on other birds captured in flight, including ducks. Found year-round in the Beaufort Sea and Chukchi Sea Planning Areas.
Perching birds	A few species of passerines nest regularly in coastal habitats of the Beaufort Sea and Chukchi Sea Planning Areas. These and other species regularly occur, but in what appear to be low numbers, in coastal and offshore areas during migration.

7.1.1.1. Listed Species

The State Endangered Species List currently does not include any birds with ranges that fall within the Beaufort Sea and Chukchi Sea Planning Areas.

Two species listed as threatened under the ESA are known to occur in the Beaufort Sea and Chukchi Sea Planning Areas (**Table C-15**). These species are the spectacled eider (*Somatria fischeri*) and the Alaskan breeding population of the Steller’s eider (*Polysticta stelleri*).

Table C-15. Federally Listed Coastal and Marine Bird Species Occurring in the Beaufort Sea and Chukchi Sea Planning Areas.

Common Name	Scientific Name	Federal Status	State Status
Spectacled Eider	*Somatria fischeri*	Threatened	Not Listed
Steller’s Eider (Alaska breeding population only)	*Polysticta stelleri*	Threatened	Not Listed

Spectacled Eider (*Somatria fischeri*)

The spectacled eider is a sea duck that spends most of the year in marine habitats from the East Siberian Sea in the west to the Beaufort Sea in the east (Sexson et al., 2014). In the summer months, spectacled eider is divided into three breeding populations in coastal areas of western and northern Alaska and northern Russia, respectively. The non-breeding distribution of the spectacled eider was unknown until advancement in satellite telemetry technology enabled individuals to be tracked away from their breeding areas. The spectacled eider is now known to winter in the northern Bering Sea.

The spectacled eider was listed in 1993 as threatened throughout its range in Alaska and Russia as a result of a major declines in the western Alaska breeding population (58 FR 27474). In 2001, the USFWS designated critical habitat considered to be essential for the conservation of spectacled eider (66 FR 9146). This habitat is located in Ledyard Bay (**Figure C-41**)

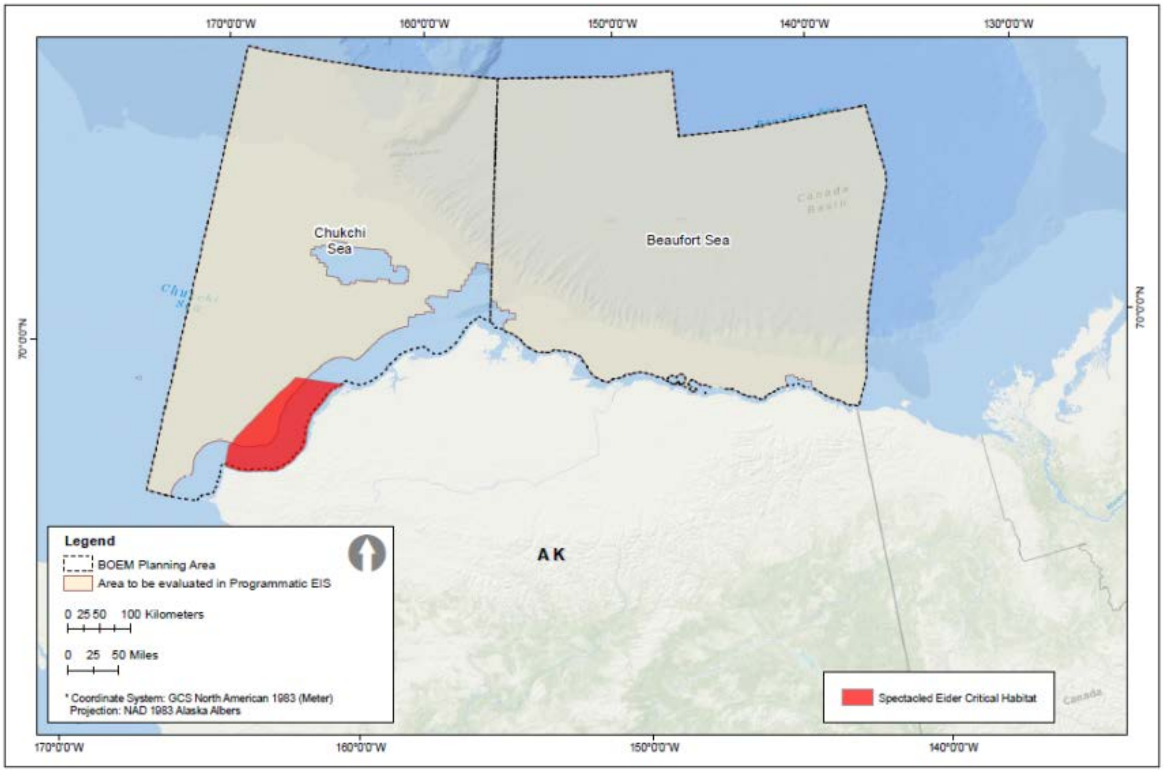


Figure C-41. Designated Critical Habitat for the Spectacled Eider in the Chukchi Sea.

Approximately two percent of the world population of spectacled eiders spend summer on Alaska's North Slope (Larned et al., 2006). Nesting occurs on tundra around freshwater ponds within approximately 80 km (50 mi) of the coast, primarily west of the Sagavanirktok River. Highest densities occur south of Oliktok Point, from Harrison Bay to south of Smith Bay, and Admiralty Bay/Barrow southwest to Wainwright.

Sexson et al. (2014) identified seven important areas for spectacled eider, two of which are located within or near the Chukchi and Beaufort Planning Areas. Both areas are used for breeding, molting, post-fledging dispersal, and pre- and post-breeding migration. These areas include the following:

(1) The western Beaufort Sea within approximately 30 km (19 mi) of the coast of northern Alaska and the coast between Point Barrow and the Sagavanirktok River Delta.
(2) The eastern Chukchi Sea within approximately 70 km (43 mi) of the coast of northern Alaska and the coast between southern Ledyard Bay and Point Barrow.
(3) Male and female spectacled eiders differ with regard to schedule and movement patterns between the nesting period and arrival at the wintering area. Males leave the breeding grounds as incubation begins, usually between early June and early July, and begin a molt migration, stopping in bays and lagoons to molt and stage prior to fall migration. Important molting and staging areas include Harrison Bay, Smith Bay, Peard Bay, Kasegaluk Lagoon, and Ledyard Bay (Johnson, 1993). Ledyard Bay is one of the primary molting areas for females breeding on the North Slope.
(4) Spectacled eider exhibits strong migratory connectivity and site fidelity over the course of the annual cycle, thereby creating spatiotemporal bottlenecks that may make it more vulnerable to disturbance (Sexson et al., 2014).

Steller's Eider (*Polysticta stelleri*)

Information about Steller's eider, including its characteristics, breeding population and nesting sites, and reasons for its declining population, are discussed in **Section 7.1.2.1**. No critical habitat has been designated for this species within or adjacent to Beaufort Sea and Chukchi Sea Planning Areas.

7.1.1.2. Candidate and Species of Concern

There are no federal candidate species in the regions of the Beaufort Sea and Chukchi Sea Planning Areas. Two recent candidate species, Kittlitz's murrelet (*Brachyramphus brevirostris*) and the yellow-billed loon (*Gavia adamsii*) were removed from the candidate species list in 2013 (78 FR 61764) and 2014 (79 FR 69195), respectively.

7.1.1.3. Migration

All native migratory birds found in the Beaufort Sea and Chukchi Sea Program Areas, including Steller's eider and spectacled eider, and their eggs, are protected from lethal take under the Migratory Bird Treaty Act.

As a consequence of extreme weather conditions and extensive sea ice, virtually all species of birds that have been reported from the Beaufort Sea and Chukchi Sea Program Areas and the adjacent coastal habitats are absent in winter (USDOI, BOEM, 2012a). Large numbers of birds migrate to or through the area in spring. Some species such as greater white-fronted goose (*Anser albifrons*) migrate to breeding habitats where they nest and raise young. Other species, including ivory gull (*Pagophila eburnea*), pass through the Beaufort Sea and Chukchi Sea Program Areas on their way to Arctic habitats in Canada. Pelagic seabird species such as short-tailed shearwater (*Puffinus tenuirostris*) move into the area in summer to forage. In late summer and early fall, many species move to molting and staging areas in preparation for their fall migrations to southern wintering areas.

A few species of passerines regularly occur in coastal and offshore areas during migration (USDOI, USFWS, 2010d). Lapland longspur (*Calcarius lapponicus*), snow bunting (*Plectrophenax nivalis*), Savannah sparrow (*Passerculus sandwichensis*), common redpoll (*Acanthis flammea*), and Hoary redpoll (*A. hornemanni*) are common breeders along the coastal plain, and are therefore likely to be found in these habitats during migratory periods (USDOI, USFWS, 2010d). Common ravens (*Corvus corax*) are uncommon permanent residents of the coastal plain and possibly rare breeders there, and American pipits (*Anthus rubescens*) are uncommon fall migrants along the coastal plain (USDOI, USFWS, 2010d). Several other migratory passerine birds are causal or rare visitors of coastal plain habitats, and are therefore not considered to be dependent upon the coastal environment.

7.1.1.4. Important Bird Areas

IBA sites designated along the coast, in nearshore waters, or offshore in the Beaufort Sea and Chukchi Sea Planning Areas are listed in **Table C-16** and shown on **Figures C-42a** and **C-42b**.

IBAs are not afforded regulatory protection unless they occur on protected federal or state lands (such as USFWS National Wildlife Refuges [NWRs]) or include ESA-designated critical habitat.

Table C-16. Important Bird Areas Identified under the National Audubon Society IBA Program in or Adjacent to Beaufort Sea and Chukchi Sea Planning Areas (From: Audubon Alaska, 2013).

IBA	Borough	Status	Priority	Importance
Teshekpuk Lake-E. Dease Inlet	North Slope	Recognized	Global	Breeding area for federally listed Steller's eider and spectacled eider. May support up to 30 percent of the Pacific Flyway brant population. Supports high densities of breeding shorebirds and waterfowl, as well as yellow-billed loon.
Ledyard Bay		Recognized	Global	Spring staging area and fall molting area for spectacled eider. Nearly all molting females pass through this area. Also important migratory staging area for other waterfowl such as king eider.
Kasegaluk Lagoon		Recognized	Global	Habitat for multiple shorebirds during the summer. Primary staging area for black brant, with up to 40,000 birds present in late summer. Hosts an Aleutian tern colony.
Beaufort Sea Nearshore		Identified	Global	Glaucous-winged gull and long-tailed duck breeding and foraging area
Northeast Arctic Coastal Plain		Recognized	Continental	Fall migration staging area for lesser snow goose, when more than 325,000 birds may be present.
Colville River Delta Marine		Identified	Global	Nesting habitat for breeding glaucous-winged gull
Beaufort Sea Shelf Edge 70° N, 152° W		Identified	Global	Foraging habitat for breeding glaucous-winged gull
Barrow Canyon and Smith Bay		Identified	Global	Habitat for thousands of breeding black-legged kittiwake, king eider, long-tailed duck, Sabine's gull, Arctic tern, and red phalarope
Chukchi Sea Nearshore		Identified	Global	Habitat for thousands of breeding Sabine's gull and glaucous-winged gull
Icy Cape Marine		Identified	Global	Habitat for thousands of breeding Pomarine jaeger and glaucous-winged gull
Point Lay Marine		Identified	Global	Habitat for thousands of breeding long-tailed duck
Lisburne Peninsula Marine		Identified	Global	Habitat for thousands of breeding black-legged kittiwake

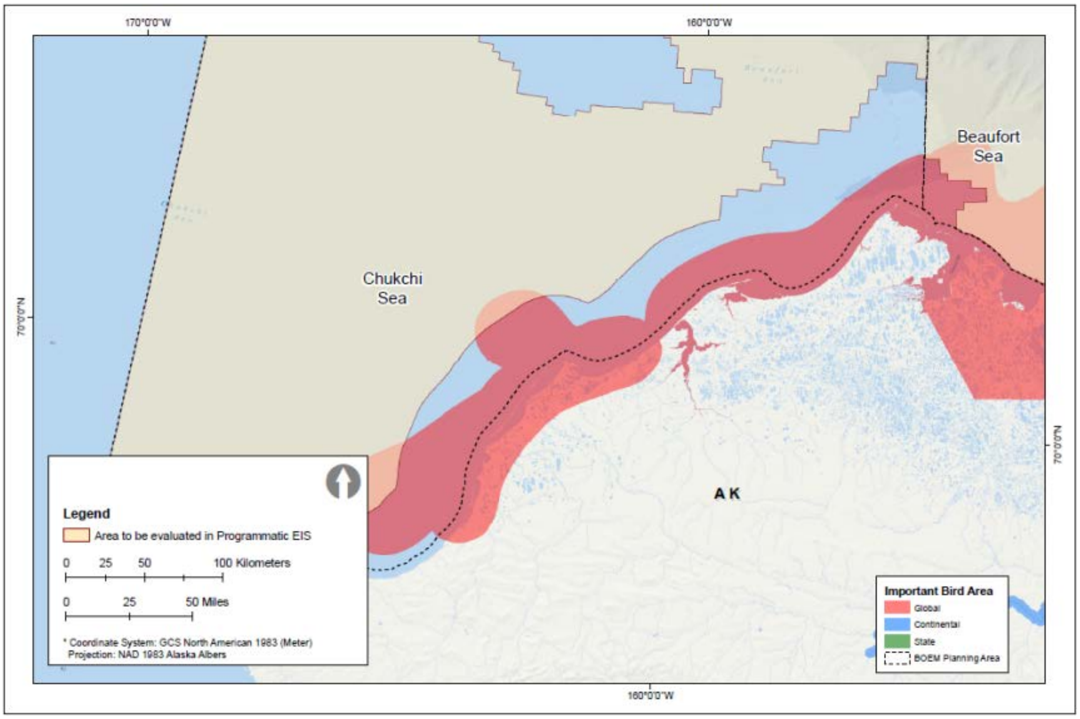


Figure C-42a. Important Bird Areas Identified under the National Audubon Society IBA Program (2015) in or Adjacent to the Beaufort Sea and Chukchi Sea Planning Areas (1 of 2).

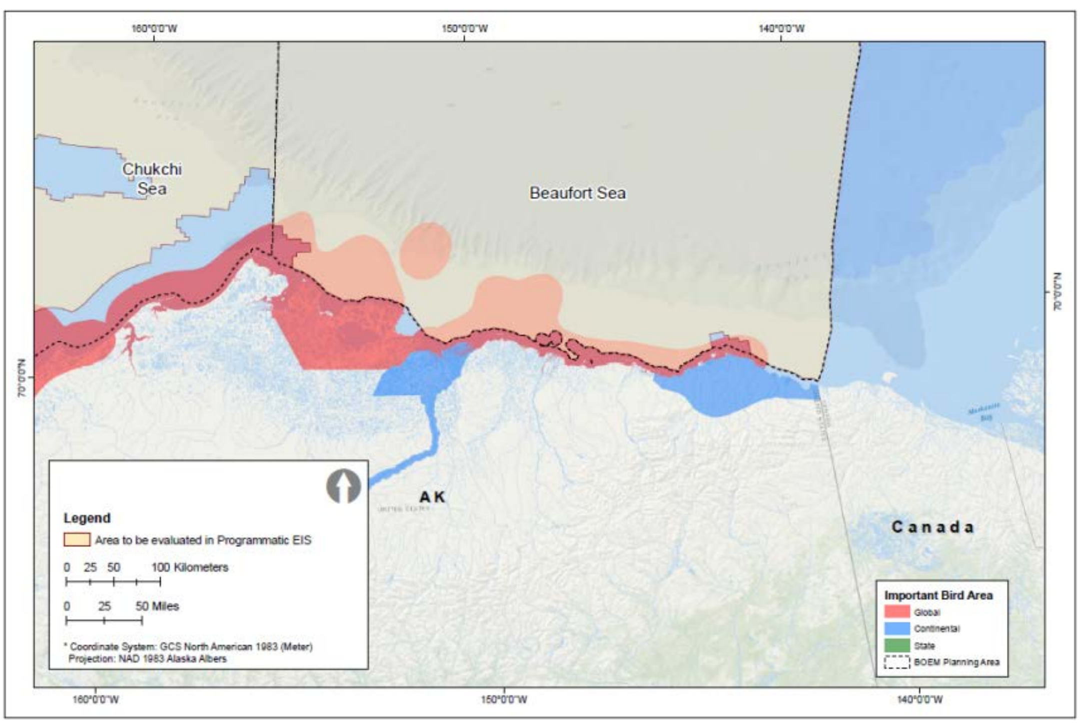


Figure C-42b. Important Bird Areas Identified under the National Audubon Society IBA Program (2015) in or Adjacent to the Beaufort Sea and Chukchi Sea Planning Areas (2 of 2).

7.1.2. Cook Inlet Planning Area

More than 492 naturally occurring avian species in 64 families and 20 orders have been identified in Alaska (University of Alaska, 2015), and 237 species have been recorded in the Kodiak Island Archipelago on the eastern margin of Cook Inlet (MacIntosh, 2009). Birds traveling to and from breeding areas in interior Alaska, the North Slope, and the west coast of Alaska use Cook Inlet during their migrations. Annual use patterns of the Cook Inlet are characterized by the sudden and rapid arrival of very large numbers of birds in spring, typically in early May, followed by an abrupt departure in mid to-late May. A peak of 175,000 shorebirds regularly occurs in Cook Inlet during spring migration (Gill and Tibbitts, 1999). Although fewer species and lower abundances of birds are present in the winter, habitats in Cook Inlet still support significant populations of overwintering birds, notably waterfowl, seabirds, and, most conspicuously, virtually the entire global population of the nominate race of rock sandpiper (*Calidris p. ptilocnemis*) (Agler et al., 1995; Larned and Zwiefelhofer, 2001; Gill et al., 2002; USDOI, USFWS, 2013).

Coastal and marine birds occurring within and adjacent to the Cook Inlet Program Area encompass dozens of species which fall into at least 11 orders and 18 taxonomic families of seabirds, waterfowl, shorebirds, wading birds, and raptors (**Table C-17**). In addition, various other species may fly over the area during migration or use adjacent terrestrial habitats during the course of the year. As in previous sections, birds are described in taxonomic families, given their commonalities within families.

Table C-17. Groups of Coastal and Marine Birds Occurring in and Adjacent to the Cook Inlet Program Area.

Representative Taxa	Description
Jaegers	Pelagic, gull-like birds, coming to land only to nest. Found in Cook Inlet Program Area during summer and during migration.
Gulls and terns	Gregarious. Nest colonially on islands and rocky coasts in Cook Inlet Program Area; found in area year-round. Gulls omnivorous and opportunistic; terns plunge-dive for small prey from water surface.
Murres, murrelets, guillemots, auklets and puffins	Pelagic, coming to land only to nest colonially. Dive for fish and crustaceans; ungainly on land. Nest colonially on islands and coastal slopes in Cook Inlet Program Area; some species remain through the winter.
Plovers	Small shorebirds which nest singly on beaches and dunes in Cook Inlet Program Area. Pick small prey from intertidal zone. Found in Cook Inlet Program Area in summer and during migration.
Oystercatchers	Medium-sized shorebirds specialized for consuming mussels and other mollusks. Nest singly on islands. Nest in Cook Inlet Program Area and found there year-round.
Sandpipers, turnstones, godwits, curlews, and phalaropes	A diverse family of shorebirds which use a variety of habitats including beaches, dunes, mudflats, salt marshes, and rocky coasts. Short-billed species pick prey from ground or water, while larger-billed species probe into mud or sand. Many species pass through during migration and a few breed in Cook Inlet Program Area. Rock sandpiper winter here.
Loons	Large waterbirds that dive for fish. Leave water only to nest. Present in Cook Inlet Program Area year-round but mainly on freshwater in summer. Can form large groups in coastal bays and nearshore waters of Cook Inlet Program Area during winter.
Cormorants	Waterbirds that sit and swim on the water and dive for fish. Nest colonially in Cook Inlet Program Area; found there year-round.
Grebes	Found in ponds, bays, and open ocean of Cook Inlet Program Area year-round. Dive from surface for fish and aquatic invertebrates. May form small groups.
Fulmars, petrels, and shearwaters	Highly pelagic and aerial species, coming to land only to nest. Found year-round in Cook Inlet Program Area. Feed from water surface or using shallow dives.

Table C-17. Groups of Coastal and Marine Birds Occurring in and Adjacent to the Cook Inlet Program Area. (Continued)

Representative Taxa	Description
Storm-petrels	Small pelagic birds primarily found well offshore but come to land for nesting. Pluck food or skim oily fat from water surface. May form very large groups. Found in Cook Inlet Program Area year-round.
Ducks, mergansers, geese, and swans	A large and diverse family which uses a variety of habitats including coastal ponds, bays, salt marshes, rivers, and open ocean. Species feed either by dabbling or diving; some have specialized diets. Found in Cook Inlet Program Area year-round.
Great blue heron	Long-legged wading birds that capture fish, reptiles, amphibians, small mammals, and aquatic invertebrates from shallow water. Roost colonially. At northwestern edge of range and rare in Cook Inlet Program Area. Primarily observed fall through spring.
Sandhill crane	Large, long-legged birds; inhabit salt marshes and agricultural fields in Cook Inlet Program Area. Breed singly and found in small to very large groups during migration. Feed primarily on vegetation. Found during summer and migration.
Falcons	Feed primarily on other birds captured in flight, including ducks. Found year-round in the Cook Inlet Planning Area.
Osprey	Diurnal raptor highly specialized for diet of fish, which it catches using plunge-dive. Found on ponds and bays. May be found in the Cook Inlet Program Area during migration.
Bald eagle	Bald eagle common in Cook Inlet Program Area year-round; scavenge and prey on fish, ducks, small mammals, and carrion.
Belted kingfisher	Relatively small birds that plunge-dive for fish in sheltered waters, including coastal bays and marshes. Nest in Cook Inlet Program Area and found there year-round.
Perching birds	Most are incidental in coastal habitats. Some such as red-winged blackbird may nest in coastal salt marshes in Cook Inlet Program Area. Large groups occur in flight across Cook Inlet during spring and fall migration.

7.1.2.1. Listed Species

The ADFG is responsible for determining and maintaining a list of endangered species in Alaska under AS 16.20.190. The State Endangered Species List currently includes the short-tailed albatross (*Phobastria albatrus*) whose ranges fall within the Cook Inlet Program Area.

Two species of federally listed endangered or threatened avian species may occur in the Cook Inlet Program Area or adjacent marine and coastal areas (**Table C-18**). These species are the endangered Short-tailed albatross (*Pheobastria albatrus)* and the threatened Steller's eider.

Table C-18. Federally Listed Coastal and Marine Bird Species Occurring in the Cook Inlet Program Area.

Common Name	Scientific Name	Federal Status	State Status
Short-tailed Albatross	*Pheobastria albatrus*	Endangered	Endangered
Steller's Eider (Alaska breeding population only)	*Polysticta stelleri*	Threatened	Not Listed

Short-tailed Albatross (*Pheobastria albatrus*)

The short-tailed albatross is a long-winged seabird that breeds on a limited number of islands in the North Pacific. It forages primarily on fish, mollusks, and crustaceans. The largest nesting colony is Tsubamezaki, located on the Japanese island of Torishima, where >60 percent of the short-tailed albatross breeding population occurs (USDOI, USFWS, 2014e). However, through translocation efforts, additional nesting colonies have been established on Torishima, the Senkaku Islands, and the Ogasawara (Bonin)

Island group. Overall, the number of breeding pairs has increased from 450 to 500 in 2008, to >750 in 2013. In the U.S., successful breeding activity has been confined to Midway Atoll, where a single pair has nested since 2010.

Non-breeding individuals, especially juveniles, are frequent visitors to U.S. waters, including the northern Gulf of Alaska, Aleutian Islands, and Bering Sea, where they may occur throughout the year (USDOI, USFWS, 2014e). Within their range this species should be considered a "continental shelf-edge specialist" rather than a coastal or nearshore species (Piatt et al., 2006).

Short-tailed albatross was listed in 2000 as endangered in the U.S. (65 FR 46643), making it so designated throughout its range. However, no critical habitat has been designated for this species within U.S. jurisdiction.

The greatest threat to short-tailed albatross continues to be the potential for volcanic eruptions on Torishima, where the largest breeding colony is located (USDOI, USFWS, 2014e). Other threats include erosion of colony sites during monsoonal rains, incidental bycatch in commercial fisheries, occurrence of parasitic cestodes and nematodes on Torishima, continuing releases of radiation from the Fukushima Daiichi Nuclear Plant, ingestion of plastics, contamination by oil and other pollutants, the potential for habitat usurpation or degradation by non-native species, and the adverse effects of climate change.

Steller's Eider (*Polysticta stelleri*)

The Steller's eider is the smallest of the four eider duck species. This species breeds in the Arctic, and the Alaskan breeding population was listed as threatened in 1997 (62 FR 31748). Three lagoons on the north side of the Alaska Peninsula have been designated as critical habitat for the Steller's eider (66 FR 8850). No critical habitat has been dedicated within or adjacent to the Cook Inlet Program Area.

The majority of the Steller's eider population nests in northeastern Siberia, with <1 percent breeding in North America. The Alaskan breeding population primarily nests on the coastal plain of the North Slope near Barrow (ADFG, 2015). On the coastal plain, Steller's eider breed on grassy edges of tundra lakes and ponds, or within drained lake basins. Although they nest in terrestrial environments, they spend the majority of their time in shallow marine waters. After nesting in the Arctic coastal plains, they move to protected marine areas along the north side of the Alaska Peninsula to molt (USDOI, USFWS, 2002).

Substantial numbers of Steller's eiders remain in lagoons on the north side of the Alaska Peninsula in winter until freezing conditions force them out (USDOI, USFWS, 2002; Larned, 2006). Many of the birds disperse to the Aleutian Islands, the south side of the Alaska Peninsula, Kodiak Island, and lower Cook Inlet for the remainder of the winter. Wintering birds usually occur in shallow waters (<10 m [30 ft] in depth) within 400 m (1,300 ft) of shore, unless the shallows extend farther offshore into bays and lagoons. In Cook Inlet, Kachemak Bay provides a primary winter concentration area for Steller's eider, with smaller areas occurring along the south central shore of Kamishak Bay on the inlet's west side, and near Ninilchik on the east (USDOC, NOAA, 2002; Larned, 2006).

While the causes for declining Steller's eider population are unknown, possible factors affecting the Alaskan population may include increased predation, subsistence hunting, ingestion of spent lead shot, habitat loss or degradation, and exposure to contaminants (USDOI, USFWS, 2002; BirdLife International, 2015).

7.1.2.2. Candidate and Species of Concern

There are no federal candidate species in the Cook Inlet Program Area. Two recent candidate species, Kittlitz's murrelet and yellow-billed loon were removed from the candidate species list in 2013 (78 FR 61764) and 2014 (79 FR 69195), respectively.

7.1.2.3. Migration

All native migratory birds found in Cook Inlet, including Steller's eider and the short-tailed albatross, and their eggs, are protected from lethal take under the Migratory Bird Treaty Act.

Many of the coastal and marine birds present in Cook Inlet use the Pacific Flyway, which extends from eastern Siberia through Alaska, and along the west coast of the Americas to Tierra del Fuego, Chile. During migration, stopover areas play a vital role in the accumulation of fat reserves that are needed for the substantial amount of energy expended by all species (Brown et al., 2001; McWilliams and Karasov, 2005). Disturbance along shorelines where the migrating birds forage can provoke additional energy requirements for the migrating birds (Helmers, 1992). The coastal wetlands and bays along Cook Inlet provide important staging habitats for migratory birds, with large seasonal aggregations of waterfowl and shorebirds.

During spring migrations, large numbers of coastal and marine birds arrive from southern wintering areas either to occupy breeding habitats along the Cook Inlet coast or to use habitats in the area as they stage for further migration northward to breeding areas in interior Alaska and along the North Slope. The rapid appearance of these birds, typically in early May, is followed by an abrupt departure in mid-to-late May (Gill and Tibbitts, 1999). At this time, species diversity and density are greatest in exposed inshore waters and in bays, lagoons, tidal mudflats, river deltas, and salt marshes, as well as along exposed outer coasts where large numbers of seabirds gather prior to completing their migration to nesting areas.

Large numbers of seabirds and some waterfowl and shorebirds remain in Cook Inlet and adjacent coastal areas to breed. Seabird nesting colonies are prominent on multiple small offshore islands and steep coastal slopes (USDOC, NOAA, 2002).

By September, seabird densities begin to decline as the birds leave nesting colonies for open marine waters, where they spend the winter (USDOI, BOEM, 2012). Migration of waterfowl and shorebirds is more protracted in the fall than in the spring, and some shorebird species may bypass Cook Inlet during the fall. Densities of geese and dabbling ducks increase in fall, as migrating birds move in from areas to the north and west.

Winter bird densities in Cook Inlet are 20 to 50 percent of those in the summer (USDOI, BOEM, 2012). Most of the decrease reflects seasonal changes in species composition as many seabirds leave areas they occupied in summer. While seabird numbers tend to be lowest during the winter, waterfowl densities increase substantially in Cook Inlet as a number of species migrate south from breeding areas on the North Slope.

Of special note, nearly the entire global population of the nominate race of rock sandpiper overwinters in Upper Cook Inlet embayments (Gill and Tibbits, 1999).

7.1.2.4. Bird Conservation Regions and Birds of Conservation Concern

There are three bird conservation regions (BCRs) located in the vicinity of the Cook Inlet Program Area (**Figure C-43**): BCR 2, Western Alaska; BCR 4, Northwestern Interior Forest; and BCR 5, Northern Pacific Forest. Forty-five bird species potentially are present in the Cook Inlet Program Area (USDOI, USFWS, 2008).

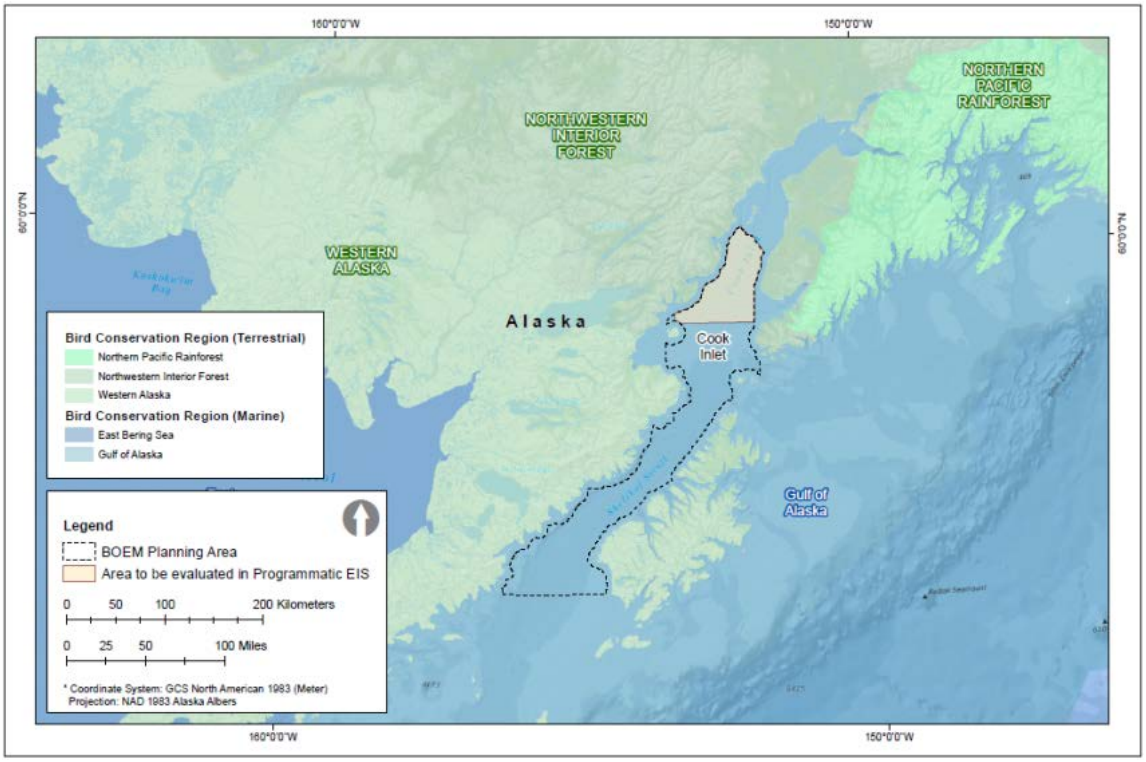


Figure C-43. Bird Conservation Regions Located in the Vicinity of the Cook Inlet Program Area.

7.1.2.5. Important Bird Areas

Important bird areas have no regulatory consequences but do provide information on avian habitats of Cook Inlet. The 23 IBA sites designated along the coast, in nearshore waters, or offshore in Cook Inlet (**Figure C-44)** are listed and briefly described in **Table C-19**.

Of the 23 sites that have been identified or recognized as IBAs in the Cook Inlet area, Kachemak Bay has also received recognition as a Site of International Importance by the Western Hemisphere Shorebird Reserve Network (WHSRN) because it hosts >100,000 shorebirds on an annual basis (WHSRN, 2009). Kachemak Bay includes approximately 515 km (320 mi) of shoreline, and provides an abundance of intertidal habitat given that tides are as much as 9 m (30 ft), for the 36 species of shorebird reported from the area.

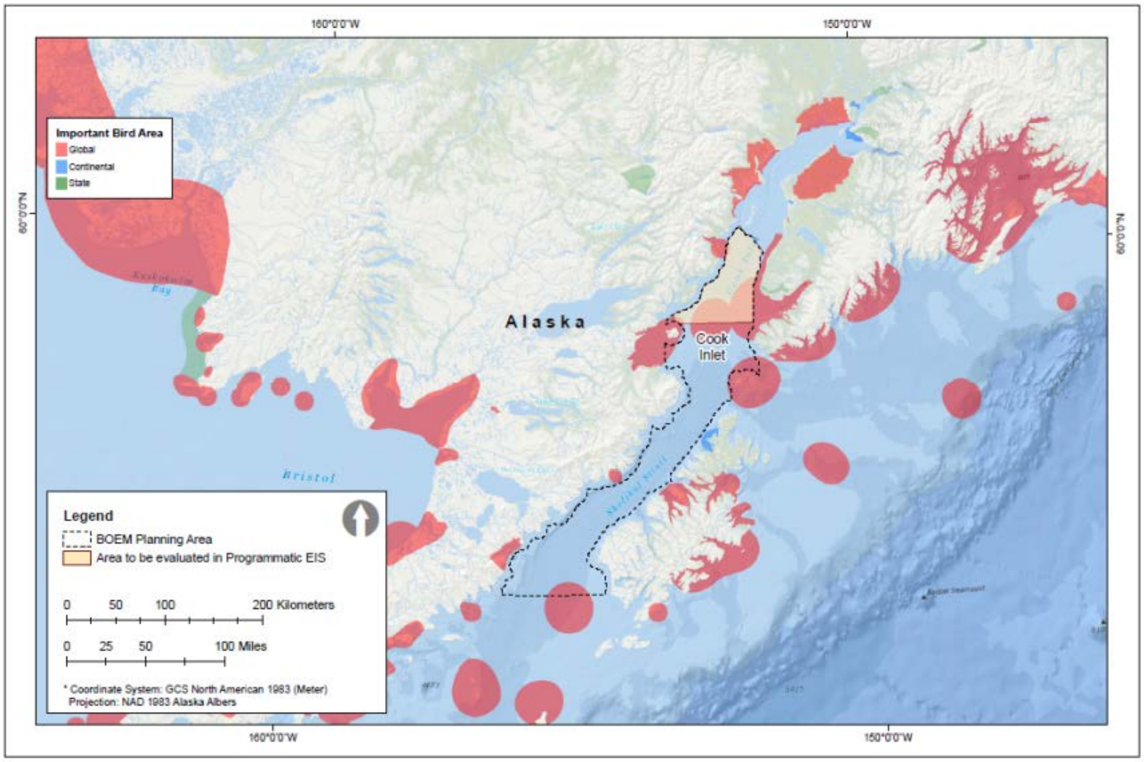


Figure C-44. Important Bird Areas Identified under the National Audubon Society IBA Program (2015) in the Cook Inlet Program Area.

Table C-19. Important Bird Areas Identified under the National Audubon Society IBA Program in or Adjacent to the Cook Inlet Program Area (From: Audubon Alaska, 2013).

IBA	County	Status	Priority	Importance (Update)
Amakdedulia Cove	Kenai Peninsula	Recognized	Continental	Seabird nesting colony; summer waterfowl congregation area
Anchor River		Recognized	State	Migratory passerine concentration area
Barren Islands Colonies		Identified	Global	Contains 6 seabird nesting colonies, supporting 14 species and >400,000 individuals; key species include pelagic cormorant, glaucous-winged gull, black-legged kittiwake, tufted puffin, and fork-tailed storm-petrel
Clam Gulch		Recognized	Global	Steller's eider wintering area; black scoter, long-tailed duck, and common eider present
Contact Point		Recognized	State	Seabird nesting colony for 6 species; spring waterfowl congregation area
Fox River Flats		Recognized	Global	Spring migration stopover area for 22 species; spring, fall, and winter waterfowl congregation area
Homer Spit	Kenai Peninsula	Recognized	Global	Steller's eider wintering area; rock sandpiper wintering area; spring migration stopover area for shorebirds, including western sandpiper and surfbird; whimbrel, wandering tattler, black oystercatcher, Pacific golden-plover, bristle-thighed curlew, Hudsonian godwit, marbled godwit, bar-tailed godwit, black turnstone, and trumpeter swan present.

Table C-19. Important Bird Areas Identified under the National Audubon Society IBA Program in or Adjacent to the Cook Inlet Program Area (From: Audubon Alaska, 2013) (Continued).

IBA	County	Status	Priority	Importance (Update)
Kachemak Bay		Identified	Global	Kittlitz's murrelet, white-winged scoter, black scoter, pelagic cormorant, marbled murrelet
Kamishak Bay		Identified	Global	Non-breeding habitat for glaucous-winged gull
Kenai River Flats		Recognized	Continental	Spring staging area for Wrangell Island snow goose; seabird nesting colonies; migrant shorebirds, waterfowl and wading birds also use the area
Lower Cook Inlet 59° N, 153° W		Identified	Global	Non-breeding habitat for glaucous winged gull
Redoubt Bay		Recognized	Global	Supports 70 percent of Cook Inlet spring migrant shorebirds; waterfowl, including multiple species of goose, swan and duck
Swanson Lakes		Recognized	Global	trumpeter swan; red-throated loon; one of highest densities of common loon in North America
Trading Bay		Recognized	Global	Wrangell Island snow goose spring staging area; rock sandpiper nominate race wintering area; spring migrant stopover area for Hudsonian godwit, whimbrel, and American golden-plover; used by red-throated loon
Tuxedni Bay		Recognized	Global	Fall migration stopover for geese; summer and fall concentration area for scoters; spring migration stopover for long-tailed duck and Western sandpiper; black scoter, black oystercatcher, black turnstone, surfbird and whimbrel present
Tuxedni Island Colony		Identified	Global	Contains a seabird nesting colony hosting 3 species, including black-legged kittiwake
Amalik Bay Colonies	Kodiak Island	Identified	Global	Contains 3 seabird nesting colonies, hosting 10 species, including red-faced cormorant
Northwest Afognak Island		Recognized	Continental	Breeding area for back oystercatcher; nesting and foraging habitat for other shorebirds and seabirds
Uganik Bay and Viekoda Bay		Recognized	Global	Contains 14 seabird nesting colonies; breeding area for black oystercatcher and other shorebirds; wintering area for multiple species of seabirds and waterfowl
Wide Bay		Recognized	Global	Contains a number of seabird nesting colonies; waterfowl, including emperor goose and Steller's eider routinely congregate in this area; bald eagle nesting sites present
Goose Bay	Matanuska-Susitna	Recognized	Continental	Spring and fall stopover for waterfowl
Palmer Hay Flats		Recognized	State	Spring and fall stopover area for waterfowl
Susitna Flats		Recognized	Global	Spring migration stopover area for waterfowl and shorebirds; rock sandpiper (nominate race) wintering area

7.2. GULF OF MEXICO PROGRAM AREA

The northern Gulf of Mexico supports a diverse avifauna and includes a variety of coastal habitats that are important to the ecology of coastal and marine bird species. The bird fauna of the northern Gulf of Mexico also includes many species that inhabit northern latitudes and pass through the region in large numbers during spring and fall migrations (Russell, 2005), or move into coastal habitats of the Gulf of Mexico to overwinter. Of the >400 species of birds that have been reported in the northern Gulf of Mexico, many of these species occur in terrestrial habitats and are not likely to occur in marine and coastal habitats where they could be affected by OCS oil and gas activities. The status, general ecology, general distribution, migratory movements, and abundance of these birds are discussed below.

This discussion focuses on six distinct taxonomic and ecological groups: passerines, raptors, seabirds, waterfowl, shorebirds, and wetland birds (**Table C-20**). Seabirds, waterfowl, shorebirds, and wetland birds represent birds that greatly utilize marine and coastal habitats (such as beaches, mud flats, salt marshes, coastal wetlands, and embayments), and thus these birds have the greatest potential for interacting with at least some phases of OCS-related oil and gas development activities, and for being affected by accidental oil spills that impact those habitats.

There are seven species of birds listed under the ESA that are found within the northern Gulf of Mexico. A discussion of the listed species and their status is provided below, followed by a discussion of species that are not listed.

Table C-20. Examples of Marine and Coastal Birds Found in the Gulf of Mexico Region.

Taxonomic/Ecological Group	Order	Examples
Passerines	Passeriformes	Sparrows, warblers, thrushes, blackbirds, and wrens
Raptors	Falconiformes	Falcon and caracaras
	Accipitriformes	Hawks, eagles, and vultures
Seabirds	Charadfriiformes	Gulls and terns
	Pelecaniformes	Frigatebirds, gannets, boobies, tropicbirds, and cormorants
	Procellariiformes	Petrels, storm petrels, and shearwaters
	Gaviiformes	Loons
	Podicipediformes	Grebes
Waterfowl	Anserifromes	Sea ducks
	Gaviiformes	Loons
Shorebirds	Charadriiformes	Sandpipers, plovers, oystercatchers, and stilts
Wetland Birds	Ciconiiformes	Egrets, herons, storks, ibises, and spoonbills
	Gruiformes	Cranes and rails
	Pelicaniformes	Cormorants

7.2.1. Listed Species

Under the ESA, there are seven threatened or endangered species of marine and coastal birds present in the northern Gulf of Mexico region: Cape Sable seaside sparrow (*Ammodramus maritimus mirabilis*) (32 FR 4001), Mississippi sandhill crane (*Grus canadensis pulla*) (38 FR 14678), piping plover (*Charadrius melodus*) (50 FR 50726), red knot (*Calidris canutus rufa*) (79 FR 73705), roseate tern (*Sterna dougallii*) (52 FR 42064), whooping crane (*Grus americana*), and wood stork (*Mycteria americana*) (77 FR 75947).

Among the threatened and endangered species, five are found in habitats adjacent to the Western and Central Planning Areas where they could be affected by OCS oil and gas activities, and three species are exclusive to Florida, adjacent to the Eastern Planning Area, where they could be affected by a CDE but not by normal OCS oil and gas operations.

The Cape Sable seaside sparrow is restricted to the Florida peninsula and is normally found along the coast; however, this subspecies occupies seasonally flooded inland prairies of muhly grass (*Muhlenbergia capillaris*), short sawgrass (*Cladium mariscus jamaicense*), and cordgrass (USDOI, USFWS, 1999a), and is not expected to occur in areas where it could be affected by normal OCS-related oil and gas operations. Piping plover and red knot are shorebirds unlikely to come directly into contact with OCS activities. Roseate tern are more likely to come into contact with OCS activities, as they forage offshore and feed by plunge-diving, often submerging completely when diving for fish. The Mississippi sandhill crane, whooping crane, and wood stork are generally wetland species, and expectations are that these would not be impacted by OCS activities outside of accidental events.

Additional threatened and endangered species occur in the coastal Gulf of Mexico. These include the red-cockaded woodpecker (*Leuconotopicus borealis*), Attwater's prairie chicken (*Tympanuchus cupido attwateri*), northern aplomado falcon (*Falco femoralis septentrionalis*), mountain plover (*Charadrius montanus*), Everglade's snail kite (*Rostrhamus sociabilis plumbeus*), Sprague's pipit (*Anthus spragueii*), and least tern (*Sterna antillarum*). They either are not considered marine or coastal birds based on their reliance on more terrestrial habitats, or they are not documented in the northern Gulf of Mexico. Therefore, as they are not likely to be adversely affected by OCS activities, these species are not discussed further.

Cape Sable Seaside Sparrow (*Ammodramus maritimus mirabilis*)

The endangered Cape Sable seaside sparrow is a passerine restricted to the Florida peninsula, occurring only in the Everglades region of Miami-Dade and Monroe Counties (**Figure C-45**) (USDOI, USFWS, 1999). The non-migratory species is associated primarily with freshwater to brackish marshes. The preferred nesting habitat of the Cape Sable seaside sparrow is the mixed marl prairie community that often includes muhly grass (USDOI, USFWS, 1999). The Cape Sable seaside sparrow is a dietary generalist that typically forages by gleaning items from low vegetation or from the substrate. They commonly feed on soft-bodied insects, marine worms, shrimp, and grass and sedge seeds. Critical habitat for the Cape Sable seaside sparrow, located in Miami-Dade County, was designated on August 11, 1977 (42 FR 40685) and revised on November 6, 2007 (72 FR 62736) (**Figure C-45**).

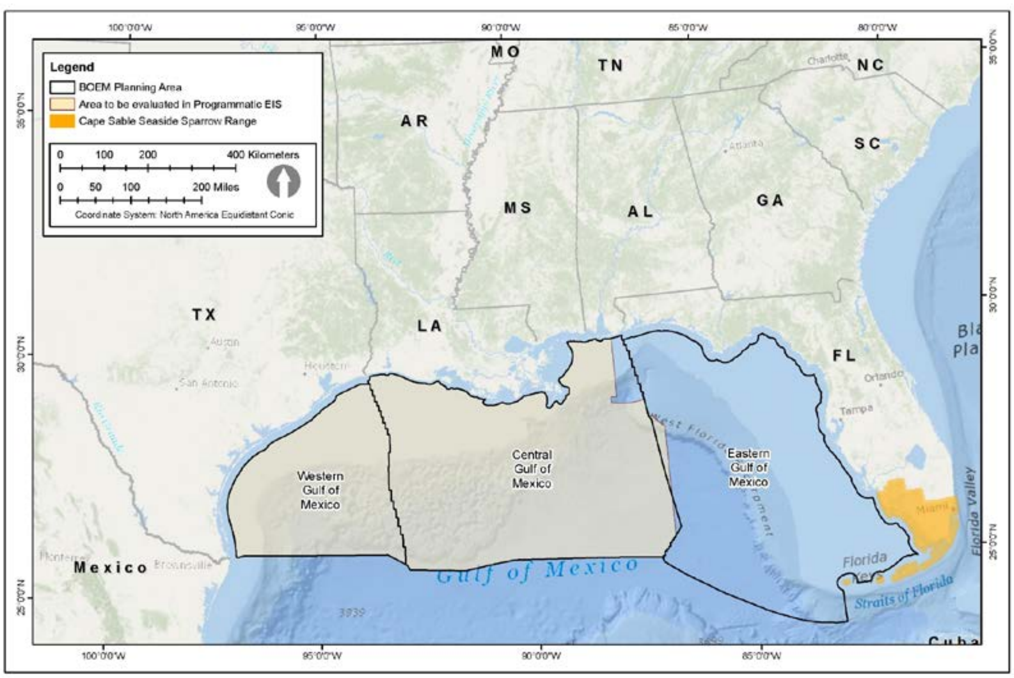


Figure C-45. Distribution of the Cape Sable Seaside Sparrow in the Gulf of Mexico Region.

Mississippi Sandhill Crane (*Grus canadensis pulla*)

The endangered Mississippi sandhill crane is a wading bird with a long neck and long legs, standing approximately 1.2 m (4 ft) tall. It displays a noticeably different, darker shade of gray than other sandhill crane subspecies. Habitats for this non-migratory species include wetland areas such as wet pine savannas, cypress strands, and Gulf coast prairies (USDOI, USFWS, 2014a). Mississippi sandhill cranes mate for life and are territorial nesters. They are omnivorous and generalists, feeding on a variety of plant tubers, grains, small vertebrates, including mice and snakes, aquatic invertebrates, insects, and worms. They feed by probing into the substrate or by picking from the ground. Their critically endangered subspecies is found only on and adjacent to the Mississippi Sandhill Crane NWR in southeast Mississippi's Jackson County (**Figure C-46**). The population is thought to consist of approximately 110 individuals, including approximately 20 to 25 breeding pairs (USDOI, USFWS, 2009). Originally, the range of the population extended along the Gulf Coastal Plain, from southern Louisiana east into Mississippi, Alabama, and the western Florida Panhandle, following the wet pine savanna habitat. The major reason for the decline of the species is attributed to habitat loss (USDOI, USFWS, 2009).

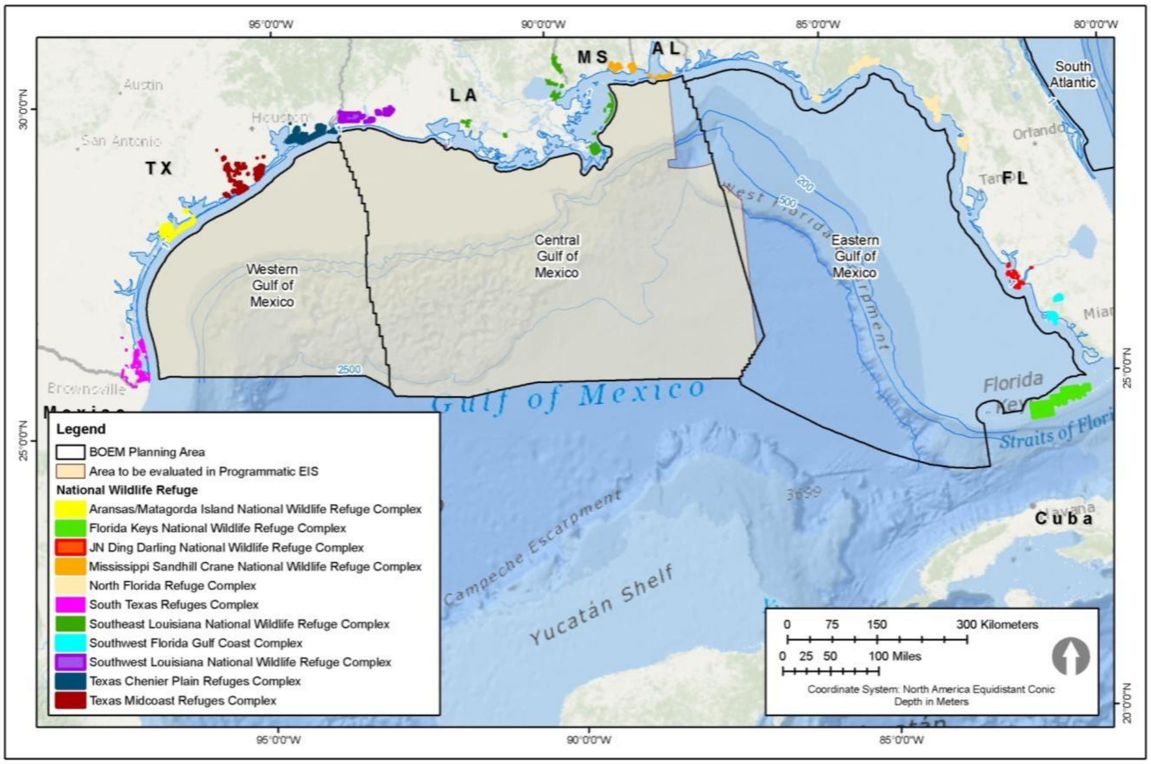


Figure C-46. National Wildlife Refuges in the Gulf of Mexico Region.

Piping Plover (*Charadrius melodus*)

The piping plover is a small, migratory shorebird that inhabits coastal sandy beaches and mudflats. They use open, sandy beaches close to the primary dune of barrier islands for breeding, preferring sparsely vegetated open sand, gravel, or cobble for nesting sites. Nesting sites are shallow depressions in the sand that piping plover often line with pebbles, shells, or driftwood, as a means of camouflage. They feed on marine worms, fly larvae, beetles, insects, crustaceans, mollusks, and other small invertebrates. They forage along the wrack zone, where dead or dying seaweed, marsh grass, and other debris are left on the upper beach by high tide (USDOI, USFWS, 2011a). Piping plover are very sensitive to human activities, and disturbances from anthropogenic activities can cause parents to abandon their nests (USDOI, USFWS, 2009).

The population of piping plovers that breeds in states bordering the Great Lakes is listed as endangered, while all other populations are listed as threatened species under the ESA, as amended (66 FR 36038). The Great Lakes piping plover population is the smallest, and its wintering population is distributed along the Atlantic and Gulf of Mexico coastlines (Stucker and Cuthbert, 2006). All piping plovers are considered threatened species under the ESA when on their wintering grounds (66 FR 36038). Individuals from threatened populations have been reported in coastal counties in all Gulf of Mexico states except Mississippi. However, individuals from the endangered population that breeds in states bordering the Great Lakes only have been reported in coastal counties of Mississippi (USDOI, USFWS, 2011b).

The USFWS first designated critical habitat for wintering piping plovers in 142 critical habitat conservation areas along the coasts of North Carolina, South Carolina, Georgia, Florida, Alabama, Mississippi, Louisiana, and Texas on July 10, 2001 (66 FR 36038). Critical habitat conservation areas were subsequently revised in Texas in 2009 (74 FR 23476). Critical wintering habitat has been designated in each of the Gulf of Mexico coastal states for the three breeding populations of the piping plover (Atlantic Coast, Great Lakes, and Northern Great Plains) (66 FR 36038). Specifically, there are 30 units on the Florida Panhandle and west coast of Florida adjacent to the Eastern Planning Area; 3 areas in Alabama, 15 in Mississippi, 7 in Louisiana, and 18 in Texas (66 FR 36038) adjacent to the Central and Western Planning Areas (**Figure C-47**). Thirty-three percent of these designated critical habitat areas are used by the Great Lakes breeding population of piping plovers (Stucker and Cuthbert, 2006).

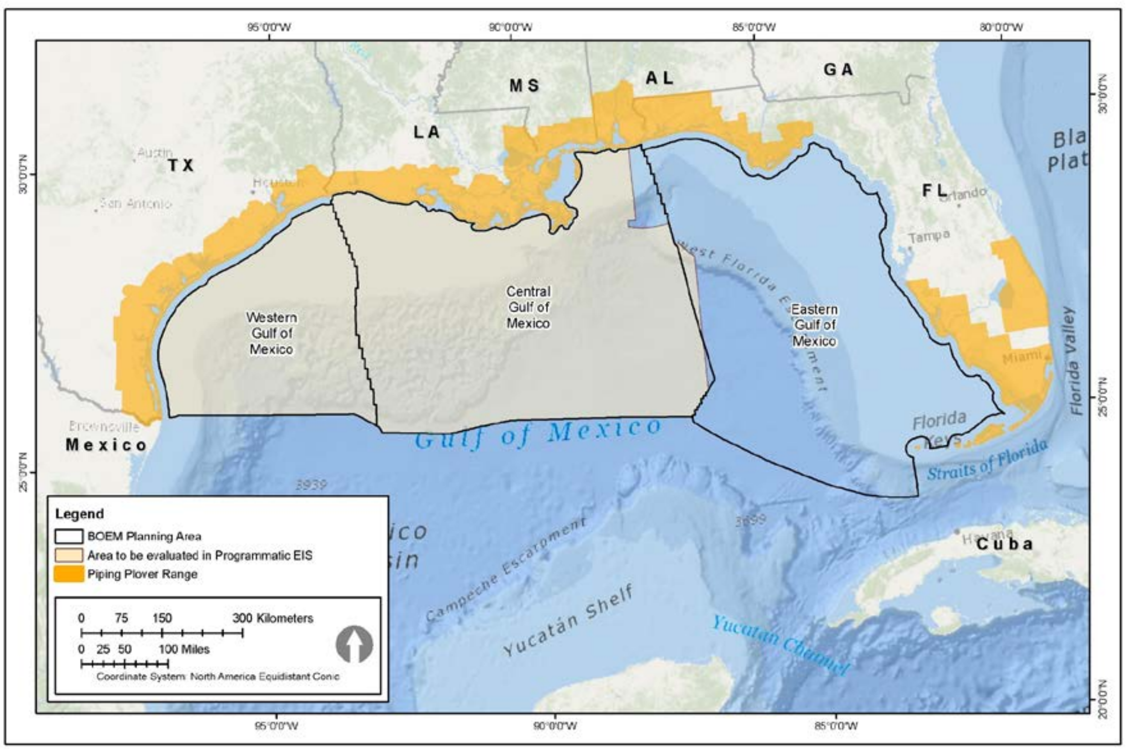


Figure C-47. Critical Habitat for the Piping Plover in the Gulf of Mexico Region.

Red Knot (*Calidris canutus rufa*)

The red knot is a medium-sized shorebird that migrates in large flocks over long distances between their mid- and high-Arctic breeding grounds, and their wintering grounds, which are primarily in coastal Patagonia in southern South America. Smaller populations winter in northeast Brazil, the southern

U.S. along the west coast of Florida and Texas, and between Georgia and South Carolina. The largest concentrations of the birds that overwinter in the U.S. are found along the southwestern coast of Florida (Harrington, 2001; Morrison et al., 2001b; USDOI, USFWS, 2013a; Normandeau Associates, Inc., 2011). Red knot migrate northward through the contiguous U.S. between April and June, and southward between July and October.

Red knot have been reported foraging along sandy beaches, tidal mudflats, salt marshes, and peat banks of each of the Gulf of Mexico states (**Figure C-48**). They also use mangrove and brackish lagoons in Florida, and beaches, oyster reefs, and exposed bay bottoms in Texas (USDOI, USFWS, 2013a).

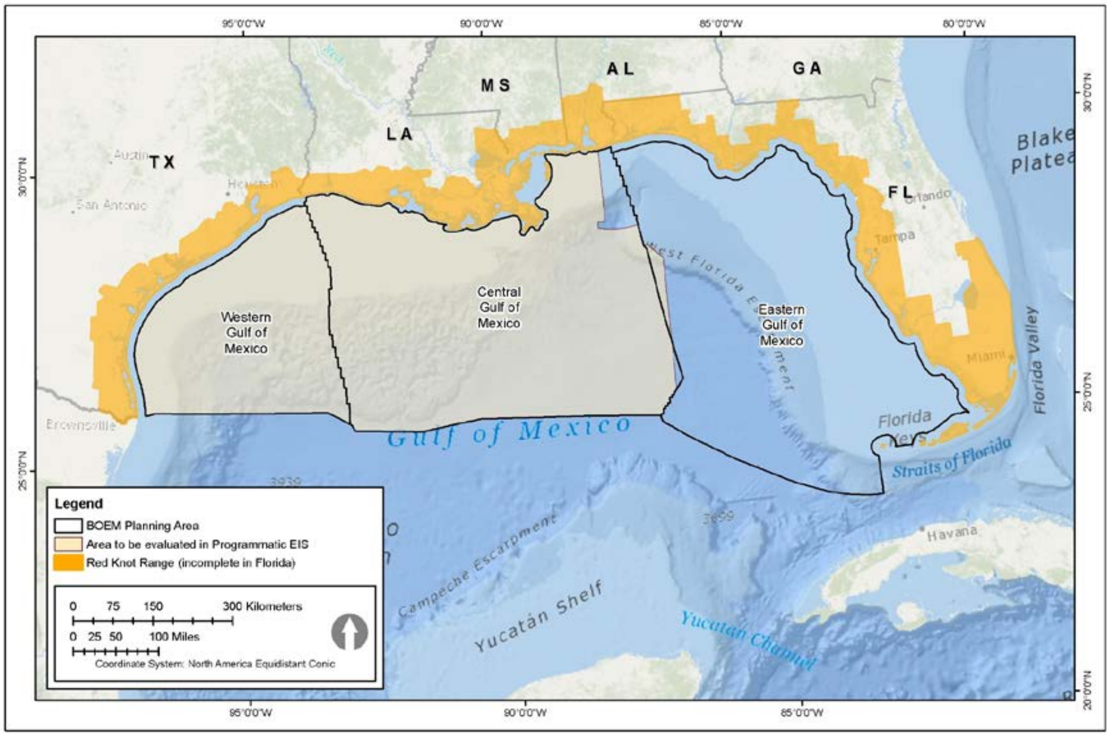


Figure C-48. Threatened Populations of the Red Knot in the Gulf of Mexico Region.

The red knot was added to the list of threatened species under the ESA (79 FR 73705) in December 2014 and the rule will became effective on January 12, 2015. No critical habitat has been designated for the red knot. Surveys at wintering and spring migration areas indicated a substantial decline in the red knot population in recent years and it is now estimated to be in the low ten thousands (Morrison et al., 2001b; USDOI, USFWS, 2013a). The primary threat to the red knot is suspected to be reduction in key food resources, particularly horseshoe crab eggs, a critical food source for this species; horseshoe crabs are harvested primarily for use as bait, and secondarily to support a biomedical industry (Morrison et al., 2004; USDOI, USFWS, 2013a). Other identified threat factors include habitat destruction by beach erosion and various shoreline protection and stabilization projects, the inadequacy of existing regulatory mechanisms to protect critical habitat, human disturbance, and competition with other species for limited food resources.

Roseate Tern (*Sterna dougallii*)

The roseate tern is a medium-sized, primarily pelagic tern that is usually found along seacoasts, bays, and estuaries, going to land only to nest and to roost (Sibley, 2000). These seabirds forage offshore, and roost in flocks typically near tidal inlets in late July to mid-September. They nest on islands on sandy beaches, open bare ground, and grassy areas, typically near areas with cover or shelter (NatureServe, 2015).

Roseate terns forage mainly by plunge-diving, contact-dipping (in which the bird's bill briefly contacts the water), or surface-dipping (in which the bird dips briefly into the water and picks prey from the surface). Foraging occurs over shallow sandbars, reefs, or schools of predatory fish. Roseate terns are adapted for fast flight and relatively deep diving, and often submerge completely when diving for fish (USDOI, USFWS, 2011c).

The roseate tern is a worldwide species that is divided into five subspecies, and only *S. dougallii* is located in the Gulf of Mexico region. The northeastern roseate tern population is thought to migrate through the eastern Caribbean and along the north coast of South America, to winter mainly on the Atlantic coast of Brazil (USDOI, USFWS, 2010a). A second population breeds on islands around the Caribbean Sea from the Florida Keys to the Lesser Antilles; this population, which is listed as threatened, is known to occur adjacent to the Eastern Planning Area in scattered colonies along the Florida Keys (USDOI, USFWS, 2011d) (**Figure C-49**). Reasons for the initial listing included the population's concentration into a small number of breeding sites, and to a lesser extent, declines in abundance (USDOI, USFWS, 1998). The most important factor in breeding colony loss was chick loss through predation by the herring gull (*Larus argentatus*) and great black-backed gull (*L. marinus*). No critical habitat has been designated for the roseate tern.

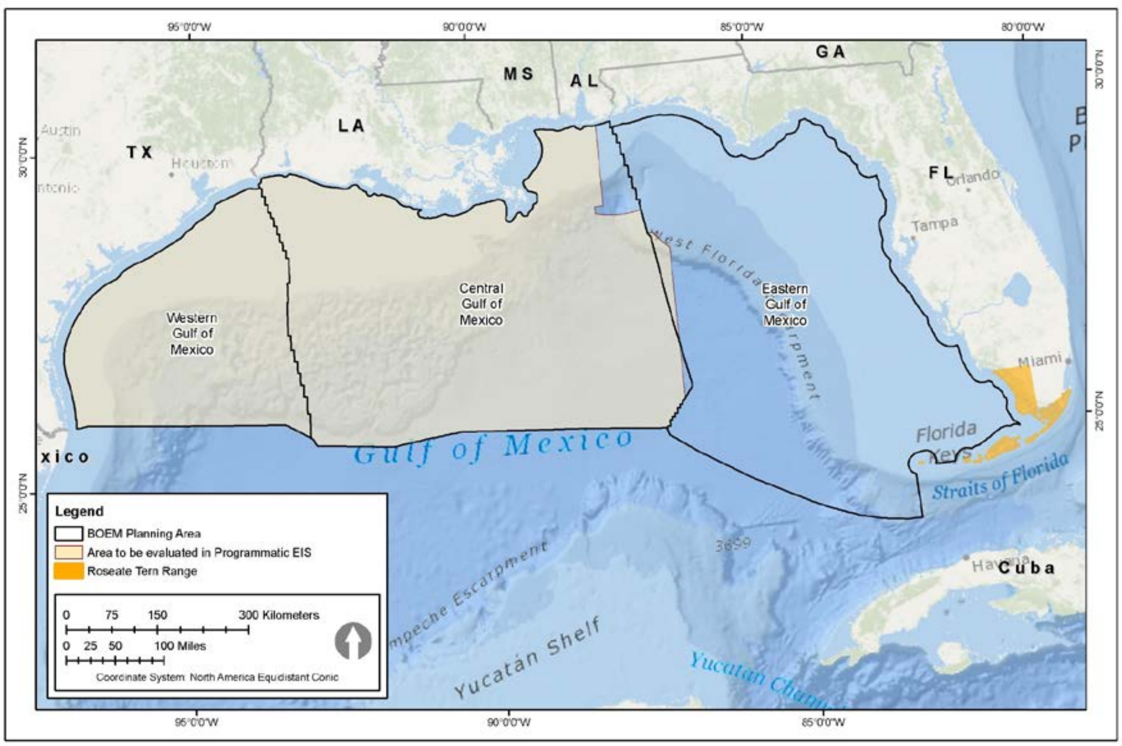


Figure C-49. Threatened Populations of the Roseate Tern in the Gulf of Mexico Region.

Whooping Crane (*Grus americana*)

The whooping crane is North America's tallest bird at 1.5 m (5 ft), and is a wetland species that nests within Wood Buffalo National Park in northern Canada, and winters on the Texas coast at Aransas NWR (Texas Parks and Wildlife, 2015). In addition, there is a small captive-raised, non-migratory population in central Florida, and a small number of individuals that migrate between Wisconsin and Florida in an eastern migratory population (USDOI, USFWS, 2014b). Three populations have been designated as nonessential experimental populations and they occur in four of the Gulf of Mexico states (Florida, Alabama, Mississippi, and Louisiana). The Aransas NWR has been designated critical habitat for the whooping crane (43 FR 36588).

The whooping crane currently is listed as endangered over its entire range, except where listed as an experimental population (**Figure C-50**). They were listed as endangered as a consequence of hunting and specimen collection, and habitat loss due to human disturbance and conversion of their primary nesting habitat. Whooping cranes mate for life and are omnivorous feeders. They feed on insects, frogs, rodents, small birds, minnows, and berries in the summer. In the winter, they focus on predominantly prey items such as blue crab (*Callinectes sapidus*) and clams, but also forage for acorns, snails, crayfish, and insects in upland areas (USDOI, USFWS, 2014b).

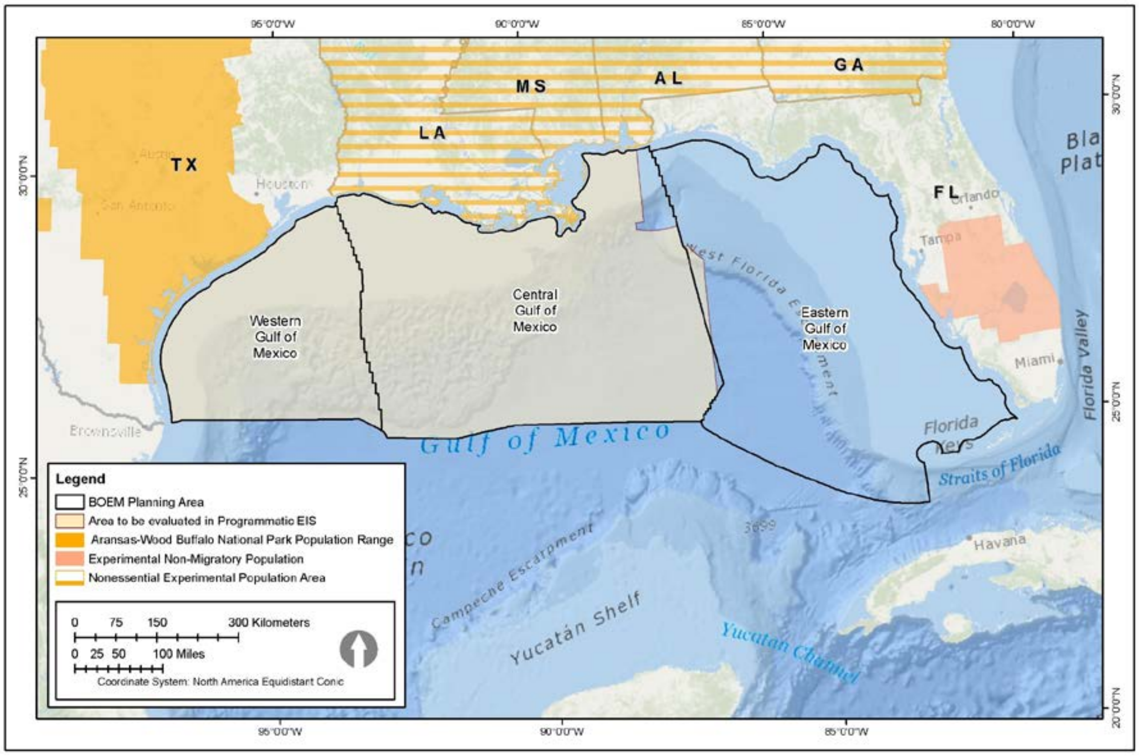


Figure C-50. Endangered and Experimental Populations of the Whooping Crane in the Gulf of Mexico Region.

Wood Stork (*Mycteria americana*)

The wood stork is a large wading bird standing >0.9 m (3 ft) tall, and is the only stork breeding in the U.S. Wood stork are year-round residents of Florida and Georgia and are wetland birds. Nesting has been restricted to Florida (in the Everglades), and to Georgia and South Carolina, but sightings have occurred in Alabama and Mississippi (**Figure C-51**). A second distinct, non-endangered population of wood stork breeds from Mexico to northern Argentina. The wood stork was placed on the federal Endangered Species List in 1984, but the species was downlisted from endangered to threatened in June 2014 (79 FR 37077-37103). The decline of the wood stork has been attributed to a reduction in its food base due to a loss of wetland habitat in south Florida (USDOI, USFWS, 2015h). No critical habitat has been designated for the wood stork.

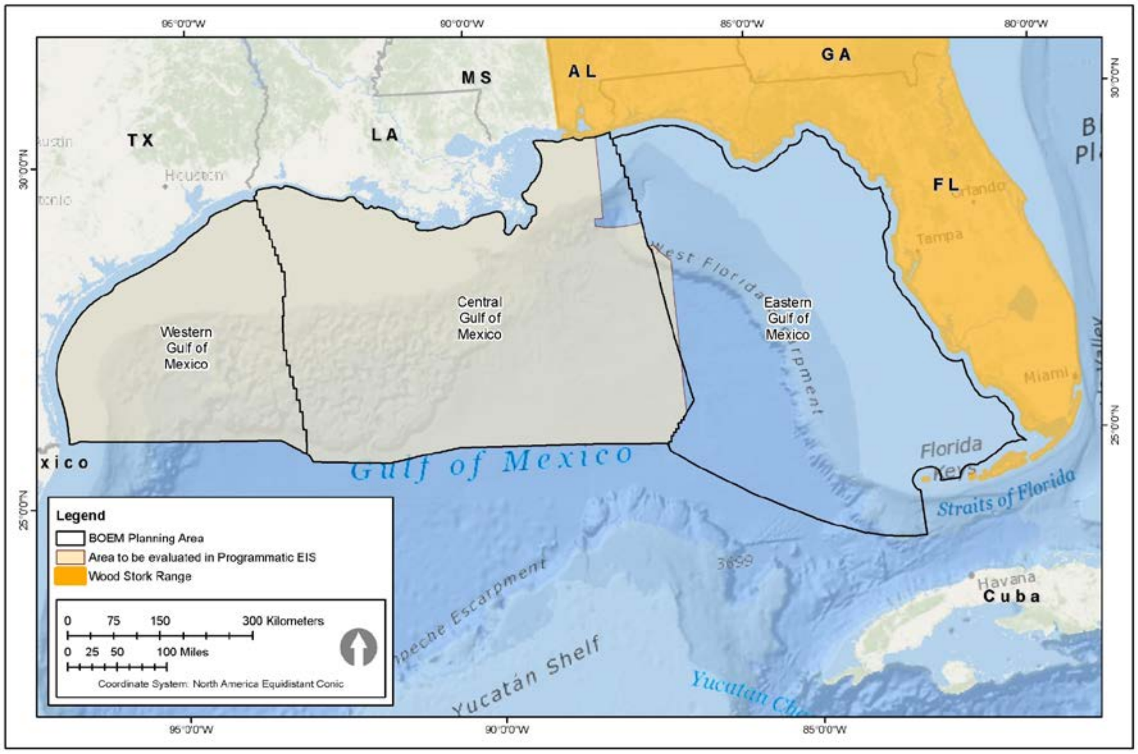


Figure C-51. Threatened Populations of the Wood Stork in the Gulf of Mexico Region.

The wood stork nests primarily in cypress or mangrove swamps, and feeds in freshwater marshes, narrow tidal creeks, or flooded tidal pools (USDOI, USFWS, 2015h). Wood stork primarily feed on small fish, up to 6 inches long such as sunfish and topminnows, using a unique feeding technique known as grope-feeding or tacto-location that requires a higher concentration of prey than required by other wading birds (USDOI, USFWS, 2015). The stork probes the water with the bill partly open and when the bill is touched by a fish, the stork quickly snaps it shut. Wood storks are highly colonial and usually nest in large rookeries with several nests in the upper branches of large cypress trees, or in island mangroves.

7.2.2. Candidate and Species of Concern

There are cases where sufficient information is available to support a proposal requesting that a species be listed as endangered or threatened, but preparation and publication of such a proposal is precluded by higher priority listing actions. In this circumstance, a species is identified as a candidate species by USFWS (71 FR 53756). No candidate species, or species of concern have been identified in the northern Gulf of Mexico.

7.2.3. Non-Listed Species of Marine and Coastal Birds

Within the Gulf of Mexico, there are both resident and migratory bird species. Resident species are present throughout the year. Migratory species may be present only during breeding and wintering seasons, or they only may migrate through the Gulf of Mexico Planning Areas. These trans-Gulf migrant birds include various species of shorebirds, wading birds, and terrestrial birds. Each spring, vast numbers of bird species migrate northward across the Gulf of Mexico en route to breeding habitats in the U.S. and Canada from their wintering sites in the neotropics: south Florida, Mexico, the Caribbean, Central America, and South America (Russell, 2005). After breeding season in the north, most of these birds return south across the Gulf of Mexico.

The >600 species of marine and coastal birds present within and adjacent to the Gulf of Mexico Planning Areas include passerines and near-passerine species such as the belted kingfisher (*Megaceryle alcyon*), raptors, seabirds, waterfowl, shorebirds, and wetland birds (**Table C-20**). Bird species within a family share common physical and behavioral characteristics. Because of these commonalities, in this section, birds will be discussed by family rather than by species. Because of common behavioral characteristics, the potential for exposure to OCS activities will be similar for species within a family.

Passerines

Passerines are perching birds, and include more than half of all bird species within one order (Passeriformes) including sparrows, warblers, thrushes, blackbirds, and wrens. For the purposes of this discussion, near-passerine species are grouped with the passerine species. Near passerines are land birds and include kingfishers, woodpeckers, hummingbirds, parrots, pigeons, cuckoos, owls, trogons, mousebirds, nightjars, and sandgrouse. The Gulf of Mexico supports a wide diversity of year-round resident passerine and near-passerine species. Many others are winter residents that move south into the Gulf of Mexico in the fall to overwinter before returning to breeding areas in more northern latitudes.

Raptors

Raptors are the birds of prey and fall into two orders: Falconiformes (falcon and caracaras) and Accipitriformes (hawks, eagles, and vultures). While most prey on birds and small mammals in terrestrial habitats, bald eagle (*Haliaeetus palliates*) and osprey (*Paridion haliaetus*) are fish eaters and may forage in coastal freshwater and saltwater habitats. Bald eagles and ospreys are present throughout the year in the Gulf of Mexico.

Seabirds

Seabirds are broadly defined by Schreiber and Burger (2002) as birds that spend a large portion of their lives on or over water, and that feed at sea. Seabirds within the Gulf of Mexico include members of five taxonomic orders (**Table C-21**): Charadriiformes (gulls, terns); Gaviiformes (loons); Pelicaniformes (pelicans, frigatebirds, gannets, boobies, tropicbirds, cormorants); Podicipediformes (grebes); and Procellariiformes (petrels, storm petrels, shearwaters). Five taxonomic orders of seabirds, which include 11 families, are found in both offshore and coastal waters of the Gulf of Mexico during their annual life cycles. Many species are present throughout the three Gulf of Mexico Planning Areas. Other species are present in only portions of the Gulf of Mexico (Peterson, 1980; Clapp et al., 1982a, 1982b, 1983).

Seabirds generally feed on localized concentrations of prey in single- or mixed species aggregations. Modes of prey acquisition include picking from the sea surface, shallow diving below the sea surface, and diving to depths of several meters (Shealer, 2002). Seabird species from the Procellariidae (petrels, prions, and shearwaters), Pelecanoididae (diving petrels), Sulidae (gannets and boobies), Phalacrocoracidae (cormorants and shags), and Laridae (gulls or seagulls) families occur within the Program Area, and regularly dive below the sea surface. Some species are known to dive to depth and remain underwater for long durations.

Table C-21. Families of Seabirds, Waterfowl, and Shorebirds Occurring in the Area of Interest.

Order	Family	General Ecology	General Distribution/Migration
Seabirds			
Charadriiformes	Laridae (Gulls, terns, and phalaropes)	Primarily inhabit coastal or inshore waters. Conspicuous and gregarious in nature. Nest colonially on the ground. Most feed on small fishes with some foraging on insects and crabs. Terns typically forage by hovering above the water's surface and plunge-diving head-first into the water from flight. Gulls seldom dive and prefer open areas. Highly adaptable.	Found predominantly along the coast but also inland in both populated and open areas. Found in the Arctic, northern Canada, and northern U.S., with some species migrating south to Mexico and South America.
	Rhyncopidae (Skimmers)	Primarily inhabit coastal and inshore waters. Nest colonially on sandy beaches. Forage for small fishes mainly at night, flying over shallow water with their elongated lower mandible below the water surface.	Year-round coastal distribution throughout the GOM Program Area.
Gaviiformes	Gaviidae (Loons)	Medium to large birds that capture fishes, crustaceans, and other aquatic organisms by diving and pursuing prey underwater. Habitat includes tundra lakes and ponds in summer, and coastal waters in winter. Nest on banks of ponds or lakes, and winter on the open water.	Holarctic in the summer in freshwater areas. Highly migratory, to more marine areas in northern Mexico for winter.
Pelicaniformes	Pelecanidae (Pelicans)	Very large, social water birds that swim buoyantly and feed predominantly on fishes and crustaceans in primarily shallow estuarine waters, occasionally up to 64 km (40 mi) from shore. Plunge bill-first into the water while fishing and often fly just above the water surface looking for prey. Nesting usually occurs on coastal islands, or on the ground, or in small bushes and trees.	Found in freshwater and marine coastal waters. Breeding range for brown pelican extends along Florida to Texas. The primary winter range for white pelican includes Florida and the GOM coast. Breeding activities extremely sensitive to human activity.
	Phaethontidae (Tropicbirds)	A mainly pelagic, highly aerial, solitary seabird found far offshore over and resting on warm water. Feed by plunge-diving. Nests in small to large colonies on tropical islands in rocky crevices, holes, or caves.	Distributed in tropical and subtropical waters. Occasionally found within the north GOM coast. Breed in Bermuda.
	Phalacrocoracidae (Cormorants)	Large, gregarious water birds found in coastal bays, marine islands, and seacoasts, usually within sight of land. Some species are found along rocky shores, while others are found on open water. Eat mostly schooling fishes captured by diving.	Migratory and dispersive. Found along temperate and tropical marine coasts. Cosmopolitan. Northern coastal populations migrate southward for nonbreeding winter season throughout the GOM, and are year-round residents along coastal Florida.
	Sulidae (Boobies)	Gregarious and colonial breeders in marine environment. Fish by plunging from air for fishes and squids. Boobies land-roost. Nest in colonies on islands and rock stacks.	Tropical, subtropical, and temperate oceans. Oceanic, with some found well offshore while others stay close to shore. Occasionally found off the GOM coast.
	Fregatidae (Frigatebirds)	Found in offshore and coastal waters. Feeding habits are pelagic and include snatching prey from the sea surface or beach, or in some cases by robbing other seabirds of their catch (kleptoparasitism).	One species (magnificent frigatebird [*Fregatta magnificens*]) occurs within the GOM Program

Table C-21. Families of Seabirds, Waterfowl, and Shorebirds Occurring in the Area of Interest (Continued).

Order	Family	General Ecology	General Distribution/Migration
			Area with breeding range along Florida to Louisiana.
Podicipediformes	Podicipedidae (Grebes)	Found in pond, lake, salt bay, and nearshore habitats. Feed by diving. Spend virtually all their time in the water and are clumsy on land.	Cosmopolitan. Migrate from inland breeding areas to temperate nearshore areas. Breed on freshwater.
Procellariiformes	Hydrobatidae (Storm-petrels)	Medium to large seabirds found over the open ocean. Come to land only for nesting. Colonial breeders. Feed on plankton, crustaceans, and small fishes. Nest on sea islands.	Breed November to May in the Antarctic and are transequatorial migrants, offshore at higher latitudes in Florida, Alabama, Louisiana, and Texas.
	Procellariidae (Shearwaters)	Highly pelagic and return to land only for breeding. Feed on fishes, squids, and crustaceans. Colonial breeders on marine islands.	Transequatorial. Most breed in the northern Atlantic and migrate south in summer as far as South America. Found at sea along the GOM coast.
Waterfowl			
Anseriformes	Anatidae (Aythyinae) (Diving Ducks)	Mainly in freshwater and estuarine environments, but species such as the greater scaup become marine during the winter. Breed in marshes. All dive for food, including aquatic vegetation, mollusks, and crustaceans.	Arctic, circumpolar during nesting season. Migrate into temperate areas in winter. Frequent inland waters, estuaries and bays, and nearshore waters. Rare to scarce in states along the GOM.
	Anatidae (Merginae) (Sea Ducks)	Found in marine environment along seacoast. Breed in marshes. All dive for food that includes fish, mollusks, and crustaceans.	Arctic, circumpolar during nesting season. Most migrate into subarctic and northern temperate areas in winter including along the coast in the GOM.
Shorebirds			
Charadriiformes	Charadriidae (Plovers)	Wading birds found along mud flats, shores, and beaches that feed on small marine life, insects, and some vegetable matter. Nest singly or in loose colonies.	Boreal, temperate, Arctic, circumpolar. Winter along coastal U.S. and GOM to South America, migrate along the coast.
	Haematopodidae (Oystercatchers)	Large wading birds found along coastal shores and tidal flats. Feed on mollusks, crabs, and marine worms.	Found in localized areas in states along the GOM.
	Recurvirostridae (Avocets and Stilts)	Slim wading birds found along beaches and mud flats. Feed on insects, crustaceans, and other aquatic organisms. Typically nest on open flats or areas with scattered tufts of grass on islands.	Breed in southwest Canada and make seasonal migrations to southern U.S. including the GOM coast, to Guatemala.
	Scolopacidae (Sandpipers, curlews, godwits, turnstones, and yellowlegs)	Small to medium-sized wading birds found along mud flats, tidal flats, shores, beaches, and salt marshes. Feed on insects, crustaceans, mollusks, and worms.	Cosmopolitan. Migrate along coast from northern North America south to the GOM and as far as southern South America.

From: Peterson (1980); Harrison (1983, 1987); Sibley (2000); Morrison et al. (2001a); NatureServe, InfoNatura (2013)
GOM = Gulf of Mexico.

Seabirds within the northern Gulf of Mexico were surveyed from ships during the GulfCet II program. Hess and Ribic (2000) reported that terns (*Sterna* spp.), storm petrels (Hydrobatidae), shearwaters (*Puffinus* spp.), and jaegers (*Stercorarius* spp.) were the most frequently sighted seabirds in the deepwater area. During these surveys, seabirds in four ecological categories were observed in the deepwater areas of the Gulf of Mexico: summer migrants (shearwaters, storm petrels, boobies [*Sula* spp.]); summer residents that breed in the Gulf (sooty tern [*Sterna fuscata*], least tern, sandwich tern [*Sterna sandvicensis*], magnificent frigatebird [*Fregata magnificens*]); winter residents (gannets, gulls, jaegers); and permanent resident species (laughing gulls [*Larus atricilla*], royal terns [*Sterna maxima*], bridled terns [*Sterna anaethetus*]) (Hess and Ribic, 2000). The GulfCet II study did not estimate bird densities; however, Powers (1987) indicates that seabird densities over the open ocean are typically <10 birds/km^2.

The distribution and relative densities of seabird species within the deepwater Gulf of Mexico vary seasonally, and spatially. In the GulfCet II studies, seabird species diversity and densities varied with the hydrographic environment, particularly the presence and location of mesoscale features such as Loop Current eddies that may enhance nutrient levels and productivity of surface waters where seabird species forage (Hess and Ribic, 2000).

In general, seabirds tend to occur at low density over much of the ocean, but are patchily distributed with comparatively higher density at *Sargassum* lines, upwellings, convergence zones, thermal fronts, salinity gradients, and areas of high planktonic productivity (Ribic et al., 1997; Hess and Ribic, 2000).

Waterfowl

Waterfowl that may occur within coastal and inshore waters of the northern Gulf of Mexico include species within the subfamilies Aythyinae (diving ducks) and Merginae (sea ducks) of the Anseriformes Order (Sibley, 2000) (**Table C-21**). Sea ducks feed and rest within nearshore and inshore waters outside of their breeding seasons, and typically form large flocks, often observed in large rafts on the sea surface during this period. Hooded mergansers (*Lophodytes cucullatus*) are the primary sea duck species that may occur within the northern Gulf of Mexico based on diving duck habitat. Members of the order Gaviiformes (loons) also may be present in coastal waters. Depending on species, they feed on fishes, mollusks, and small invertebrates (Sibley, 2000). Diving ducks include the canvasback (*Aythya valisineria*), ring-necked duck (*A. collaris*), lesser and greater scaup (*A. affinis* and *A. marila*, respectively), bufflehead (*Bucephala albeola*), and common goldeneye (*B. clangula*). They are gregarious and mainly found in freshwater or in estuarine environments, although species such as the greater scaup move to marine environments during the winter. Diving ducks feed on aquatic vegetation, mollusks, and crustaceans. Similar to diving seabirds, sea ducks and some diving ducks may be vulnerable to underwater noise produced during OCS oil and gas activities since they dive beneath the water surface in coastal waters for feeding. However, most diving seabirds and sea ducks are located in bays and estuaries, which are outside of the Gulf of Mexico Planning Areas; they could be affected by an accidental event but not by normal OCS oil and gas operations.

Shorebirds

The term shorebird applies to a large group of birds. Some of these are sandpipers and plovers, but the group also includes oystercatchers, avocets, and stilts. Shorebirds utilize coastal environments for nesting, feeding, and resting. Shorebird species found primarily along the coastline of the northern Gulf of Mexico are included within the Order Charadriiformes (along with gulls and terns) (**Table C-21**) from four families: Charadriidae (plovers), Haematopodidae (oystercatchers), Recurvirostridae (avocets and stilts), and Scolopacidae (sandpipers). Fifty-three species of shorebirds regularly occur in the U.S. (Brown et al., 2001) with 43 species occurring during migrational or wintering periods in the Gulf of Mexico. Six shorebird species, American oystercatcher (*Haematopus palliates*), snowy plover (*Charadrius alexandrines*), Wilson's plover (*C. wilsonia*), willet (*Catoptrophorus semipalmatus*), killdeer

(*Charadrius vociferous*), and black-necked stilts (*Himantopus mexicanus*), breed in the Gulf of Mexico (Helmers, 1992).

Recent trend analyses of shorebird abundance in various parts of the U.S. indicate that many species are declining, including many species that are present along the shorelines adjacent to the northern Gulf of Mexico (Morrison et al., 2001a, 2006). This decline in shorebird abundance is believed to be from multiple factors including the environmental degradation of shoreline habitats, industrial and recreational development of multiple breeding and wintering habitats, climate change potentially affecting Arctic breeding sites, and alterations to coastal areas from sea level rise. In addition, global climate change may also alter prevailing wind patterns which may affect ocean upwelling and productivity, in turn affecting shorebird abundance and distribution (Morrison et al., 2001a).

The Lower Mississippi and western coast of the Gulf of Mexico is rich with a variety of shorebird habitats and the Gulf of Mexico coast has some of the most important shorebird habitat in North America, particularly the Laguna Madre ecosystem along the south Texas coast (Brown et al., 2001; Withers, 2002). Resident shorebirds primarily rely on the shorelines adjacent to the Gulf of Mexico Program Area for their life functions; however, some shorebird species cross the Gulf of Mexico during their annual migration.

Wetland Birds

The wetland birds include a diverse array of birds from four orders (Ciconiiformes, Gruiformes, Pelicaniformes, and Podicipediformes) that typically inhabit most coastal aquatic habitats of the northern Gulf of Mexico, including freshwater swamps and waterways, brackish and saltwater wetlands, and embayments. This group includes wading birds such as herons, egrets, cranes, rails, and storks, as well as diving birds such as cormorants and grebes. Most wetland birds are year-round residents of Gulf of Mexico coastal areas. Wetland birds feed on primarily fish and invertebrates (Sibley, 2000) and are susceptible when their habitats are disturbed, degraded, or lost.

7.2.4. Migration

A migratory bird is any species of bird that migrates, and lives or reproduces, within or across international borders at some point during its annual life cycle. Migratory birds and their nests are protected under the Migratory Bird Treaty Act. Migratory movements of most marine and coastal birds across North America are known only in general terms (Harrington and Morrison, 1979). Many North American birds seasonally migrate long distances between northern habitats in the high Arctic, New England, and Canada and southern habitats in Florida and Central and South America, often traveling as far as 12,000 km (7,457 mi) from breeding to wintering grounds (Helmers, 1992). These birds use four flyways: Atlantic, Mississippi, Central, and Pacific (**Figure C-52**). There are significant differences between species in migratory routes (Rappole, 1995). Upwards of 40 percent of all North American migrating waterfowl and shorebirds use the Mississippi Flyway (USDOI, USFWS, 2013b), which runs through the peninsula of southern Ontario across several states to the mouth of the Mississippi River. Many marine and coastal birds, as well as terrestrial bird species migrating to the tropics, follow the Mississippi Flyway and take a short cut across the Gulf of Mexico (Nutty Birdwatcher, 2015). During migration, stopover areas provide resting and feeding opportunities needed by migrating birds to sustain themselves during their migrations (Brown et al., 2001; McWilliams and Karasov, 2005). Migrating birds sometimes will use offshore structures such as oil and gas production platforms, for rest stops or as temporary shelters from inclement weather. Disturbance along the shoreline where migrating birds forage can deny them the rest and food they need to complete their migrations in good health (Helmers, 1992).

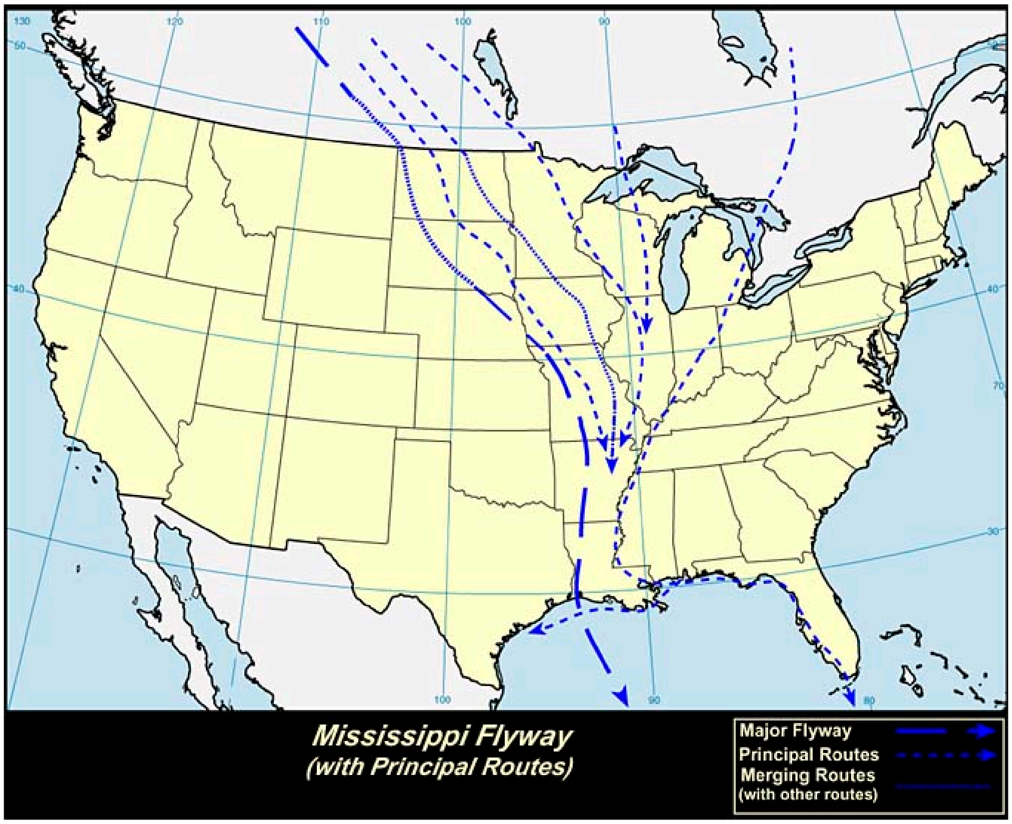


Figure C-52. Mississippi Flyway (From: North American Migration Flyways, 2015).

7.2.5. Bird Conservation Regions and Birds of Conservation Concern

The Fish and Wildlife Conservation Act (FWCA) was amended in 1988 to mandate the USFWS to "identify species, subspecies, and populations of all migratory nongame birds that, without additional conservation actions, are likely to become candidates for listing" under the ESA. The USFWS prepared a document to identify birds of conservation concern to comply with this mandate (USDOI, USFWS, 2008). The goal of the document was to identify all migratory and non-migratory bird species with high conservation priorities, in addition to those species already federally designated as threatened or endangered. The development of the birds of conservation concern took into account three geographic scales addressed by three bird conservation initiatives: North American Bird Conservation Initiative (NABCI) BCRs, USFWS Regions, and National Regions (USDOI, USFWS, 2008).

The North American Bird Conservation Initiative BCRs were developed by a mapping team with members from the U.S., Mexico, and Canada to provide a consistent spatial framework for bird conservation in North America. During mapping, a hierarchical framework was developed of nested ecological units (or BCRs). There are four located inland, adjacent to the northern Gulf of Mexico: Unit 26, the Mississippi Alluvial Valley BCR; Unit 27, the Southeastern Coastal Plain BCR; Unit 31, the Peninsular Florida BCR; and Unit 37, the Gulf Coastal Prairie BCR (U.S. NABCI Committee, 2000) (**Figure C-53**). USFWS (2008: Tables 24, 25, 33 and 35) lists all birds of conservation concern (except for the red knot, which only recently has been listed) that may be present in BCRs adjacent to the Gulf of Mexico Program Area (**Table C-22**). Shorebirds are, in general, of high conservation concern (U.S. NABCI Committee, 2009), with nearly half of the marine bird species in the U.S. of conservation concern (U.S. NABCI Committee, 2014).

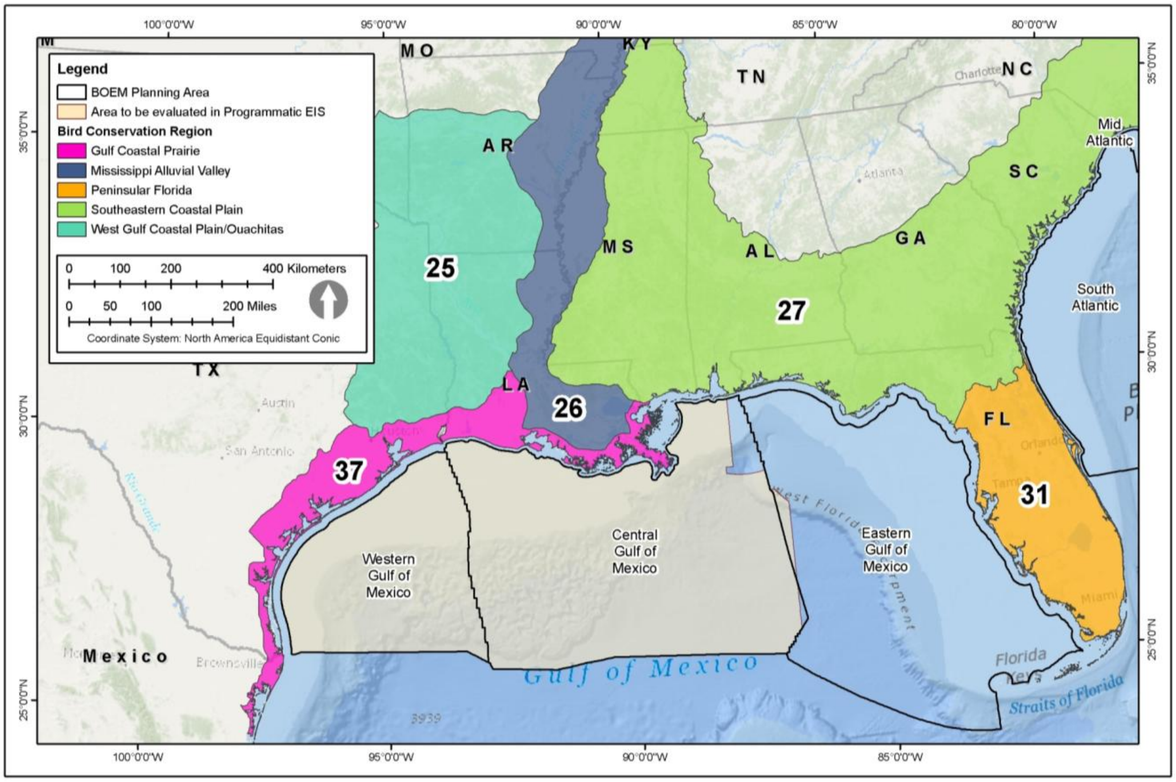


Figure C-53. Bird Conservation Regions in the Southeastern U.S.

Table C-22. Species of Concern in Bird Conservation Regions Adjacent to the Northern Gulf of Mexico.

BCR Designation	Number of Bird Species of Conservation Concern	Number of Marine and Coastal Bird Species of Species of Conservation Concern
26	26	5
27	53	19
31	49	18
37	44	21

7.2.6. Important Bird Areas

The IBA Program was developed by the National Audubon Society as a global effort to identify and to conserve areas that are vital to birds and other biota. IBAs provide essential habitat for one or more species of bird, and include sites for breeding, wintering, or migrating birds. By definition (National Audubon Society, 2011), IBAs are sites that support:

- species of conservation concern (e.g., threatened or endangered species);
- species vulnerable because they are not widely distributed;
- species vulnerable because their populations are concentrated in one general habitat type or biome; and/or
- species or groups of similar species (such as waterfowl, or shorebirds) that are vulnerable because they occur at high densities when they congregate.

Some IBAs are protected by federal or state regulations (e.g., NWRs and national parks), while others may have no legal protection. IBAs are not afforded regulatory protection unless they occur on protected federal lands such as NWRs, or on protected state lands, or include ESA-designated critical habitat. IBA sites are located throughout the U.S. including along the coast, in nearshore waters, and offshore (**Figure C-54)**. The Audubon Society has identified 71 IBAs along the coast of the Gulf of Mexico that might interact with OCS oil and gas activities in the Gulf of Mexico (Audubon Society, 2010). These include 17 sites in Texas, 7 in Louisiana, 7 in Mississippi, 4 in Alabama, and 36 in Florida (**Figure C-55**).

IBA sites along the Gulf of Mexico provide important overwintering habitat for some species, as well as important migration stopovers for land birds. A large variety of waterfowl, shorebirds, wading birds, and migrating passerines forage and rest in IBA habitats. Additionally, IBAs are important breeding grounds for shorebirds.

Furthermore, the Gulf of Mexico includes NWRs (**Section 9**), some of which include coastal habitat. These refuges, 7 in Texas, 2 in Louisiana, 1 in Mississippi, 1 in Alabama, and 13 in Florida, are primarily managed for the protection and conservation of migratory birds (USDOI, USFWS, 2014c).

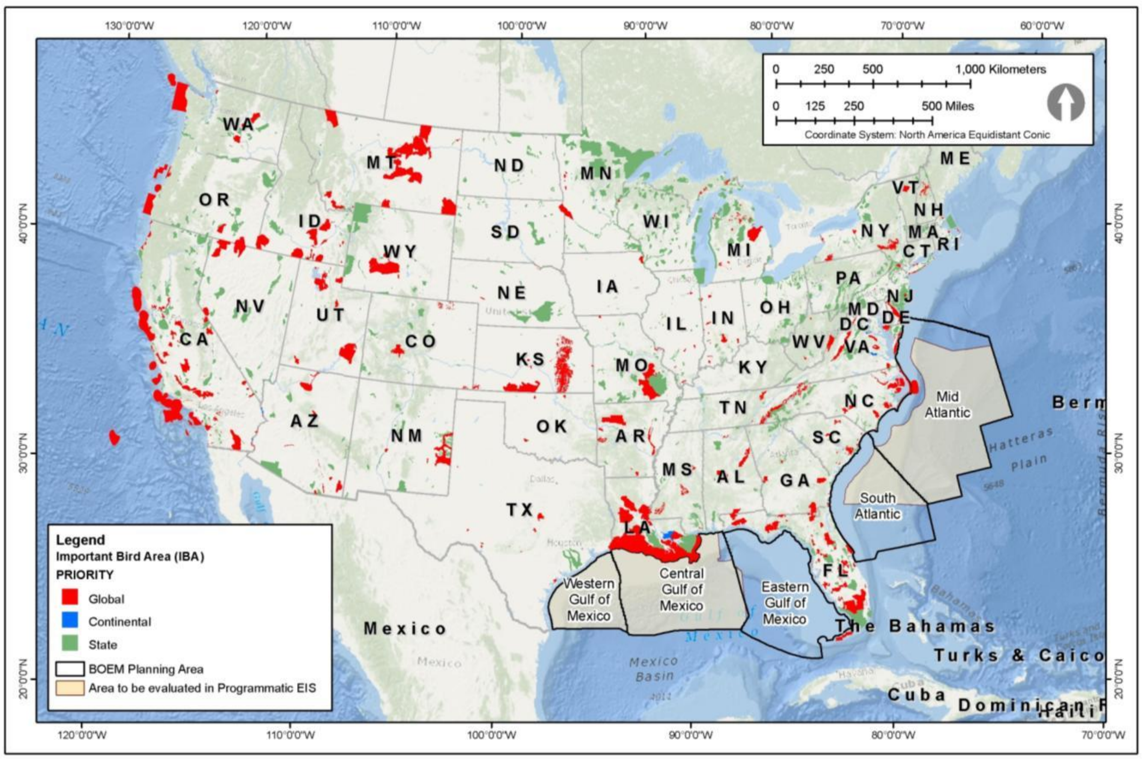


Figure C-54. National Audubon Society's Important U.S. Bird Areas.

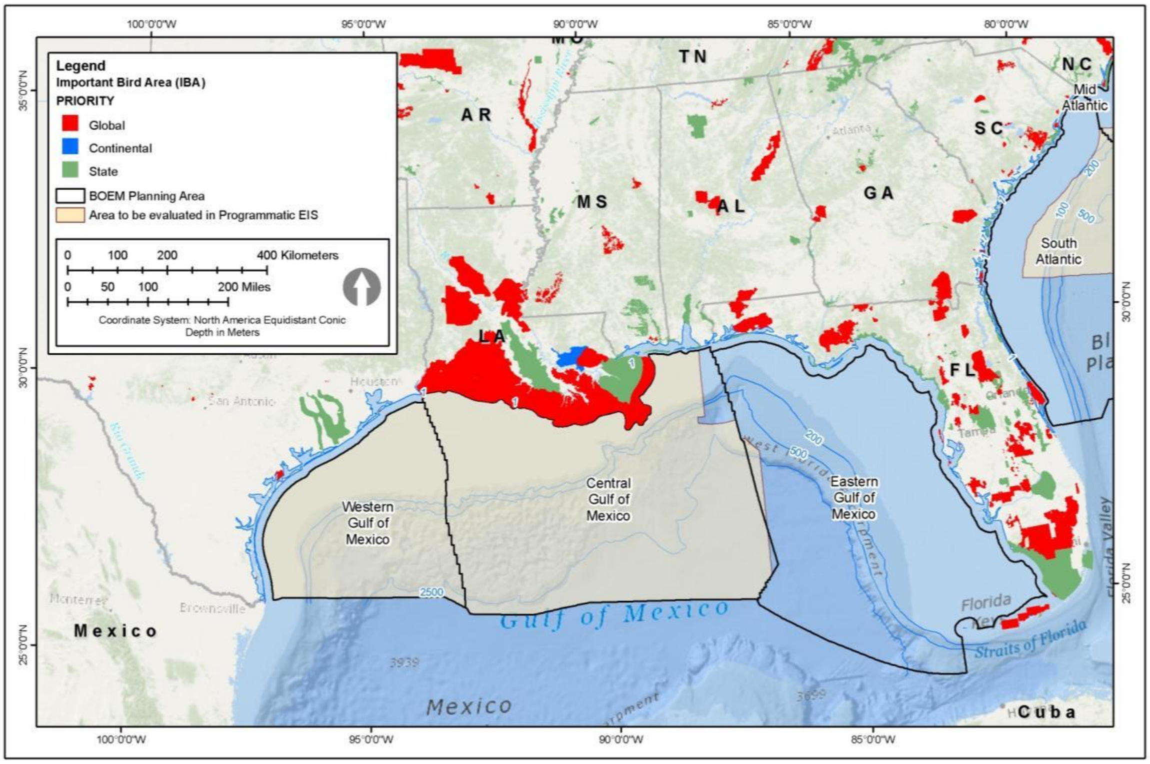


Figure C-55. National Audubon Society's Important Bird Areas in the Southeastern U.S.

7.3. ATLANTIC PROGRAM AREA

This section discusses the birds that utilize coastal and marine habitats during breeding, feeding and wintering that could be affected by spills within the Atlantic Program Area, specifically, in Virginia, North Carolina, South Carolina, and Georgia **(**Figure 2.1-3 in the Programmatic EIS). The discussion in this section includes a general overview of the groups of coastal and marine birds, federally listed and candidate species, migratory birds, and IBAs with ranges within the Atlantic Program Area.

The coastline adjacent to the Atlantic Program Area supports diverse avifauna and includes a variety of coastal habitats that are important to the ecology of coastal and marine bird species. This discussion focuses on 14 distinct taxonomic orders and 30 taxonomic families within these orders. The status, general ecology, general range, migratory movements, and abundance of these birds are discussed below.

Within the Mid-Atlantic Planning Area and adjacent coasts, there are five species listed under the ESA. Four of these also occur along coasts adjacent to the South Atlantic Planning Area. A discussion of the listed species and their status is provided below, followed by a discussion of species that are not listed.

Within the Atlantic Program Area and adjacent coasts, numerous marine and coastal bird species are present, including both resident and migratory species. Resident species are present throughout the year, whereas migratory species may be present only during breeding and wintering seasons, or they only may migrate through the Atlantic Program Area. Resident and migrant birds include species that rely on marine and coastal waters.

Coastal and marine birds present within and adjacent to the Atlantic Program Area encompass hundreds of species which fall into 14 taxonomic orders and 30 taxonomic families (**Table C-23)**. Bird species within a family share common physical and behavioral characteristics. Given these commonalities, characteristics of taxonomic families rather than those of individual species are summarized in **Table C-23**. Because of common behavioral characteristics, the potential to be affected by oil and gas activities on the OCS will be similar for species within individual families.

Table C-23. Groups of Coastal and Marine Birds Occurring in and Adjacent to the Atlantic Program Area.

Representative Taxa	Description
Skuas and jaegers	Pelagic, gull-like birds, coming to land only to nest. Found in Atlantic Program Area during winter and migration.
Gulls, terns, and skimmers	Gregarious. Nest colonially on beaches in Atlantic Program Area; found in Program Area year-round. Gulls omnivorous and opportunistic; terns plunge-dive for small prey from water surface; skimmers highly specialized.
Razorbill and murres	Pelagic, coming to land only to nest colonially. Dive for fish and crustaceans; ungainly on land. Found in Atlantic Program Area only during winter.
Plovers	Small shorebirds which nest singly on beaches and dunes in Atlantic Program Area. Pick small prey from intertidal zone. Found in Atlantic Program Area year-round.
Oystercatchers	Medium-sized shorebirds specialized for consuming oysters and other mollusks. Nest singly on sandy beaches and dunes. Nest in Atlantic Program Area and found there year-round.
Avocets and stilts	Slender, long-legged birds that inhabit marshy areas, including coastal marshes and beaches. Capture small invertebrate prey from water. Nest in Atlantic Program Area and found there year-round.
Sandpipers, turnstones, dowitchers, godwits, yellowlegs, curlews, and phalaropes	A diverse family of shorebirds which use a variety of habitats including beaches, dunes, mudflats, salt marshes, and rocky coasts. Short-billed species pick prey from ground or water, while longer-billed species probe into mud or sand. Found in Atlantic Program Area year-round, though few species nest there.
Loons	Large waterbirds that dive for fish. Leave water only to nest. Can form large groups in coastal bays and nearshore waters of Atlantic Program Area during winter.
Pelicans	Large waterbirds typically seen sitting on the water or in flight. Plunge-dive for fish in shallow water. Nest colonially on isolated islands in Atlantic Program Area; found there year-round.
Gannets	Large pelagic species found in nearshore waters of Atlantic Program Area during winter. Plunge-dive for fish and pursue prey underwater.
Frigatebirds	Highly aerial; soar over nearshore waters. Pluck fish from water; often steal prey from other seabirds. Roost colonially.
Tropicbirds	Highly pelagic species; typically stays far from land. Sit on water surface and catch fish from plunge-dive. Nest on Bermuda, found in Atlantic Program Area during migration.
Cormorants	Waterbirds that sit and swim on the water and dive for fish. Roost colonially on perches with spread wings. Nest colonially in Atlantic Program Area; found there year-round.
Grebes	Found in ponds, bays, and open ocean of Atlantic Program Area year-round. Dive from surface for fish and aquatic invertebrates. May form small groups.
Fulmars, petrels, and shearwaters	Highly pelagic and aerial species, coming to land only to nest. In Atlantic Program Area, usually found far offshore, primarily during winter and migration. Feed from water surface or using shallow dives.
Storm-petrels	Small pelagic birds primarily found in deep ocean waters, but occasionally come near land. Pluck food from water surface. May form very large groups. Found in Atlantic Program Area during migration.
Ducks, scoter, eider, mergansers, goldeneyes, geese, and swans	A large and diverse family which uses a variety of habitats including coastal ponds, bays, salt marshes, rivers, and open ocean. Species feed either by dabbling or diving; some have specialized diets. Found in Atlantic Program Area year-round; sea ducks found primarily in winter.
Storks	Large, uncommon species found in muddy ponds. Colonial; feed by catching fish from water using large bill. Nest in Atlantic Program Area and found there year-round.

Table C-23. Groups of Coastal and Marine Birds Occurring in and Adjacent to the Atlantic Program Area (Continued).

Representative Taxa	Description
Herons, egrets, bitterns, and night-herons	Long-legged wading birds that capture fish, reptiles, amphibians, small mammals, and aquatic invertebrates from shallow water. Nest and roost colonially; some species secretive. Many species nest in coastal areas of Atlantic Program Area and found there year-round.
Ibis and spoonbill	Similar to herons and egrets. Ibis has long, decurved bill used to probe muddy ponds and salt marshes for prey. Spoonbill forage by sweeping bill through water. Colonial. Ibis nest in Atlantic Program Area and found there year-round. Spoonbill uncommon in Atlantic Program Area but may be found there during migration.
Rails and coots	Rails secretive and inhabit coastal marshes; feed on invertebrates and plants. Several species breed in Atlantic Program Area and found there year-round. Coots duck-like and inhabit ponds and marshes, often near coast. Coots found in Atlantic Program Area during winter.
Limpkin	Inhabit wooded swamps, primarily in Florida. Long-billed and long-legged. Search shallow water for mollusks, especially apple snails.
Cranes	Large, long-legged birds; inhabit salt marshes and agricultural fields in Atlantic Program Area. Found in small to very large groups. Feed primarily on vegetation. Experimental population of critically endangered whooping crane found in Atlantic Program Area, along with more common sandhill crane (*Grus canadensis*).
Falcons, kestrels, and caracaras	Peregrine falcon and merlin (*Falco columbarius*) often found along coast. Feed primarily on other birds captured in flight. For the peregrine falcon, these include ducks.
Osprey	Diurnal raptor highly specialized for diet of fish, caught using plunge-dive. Found on ponds, bays, and along beaches. Nest throughout Atlantic Program Area and found there year-round.
Eagles, hawks, kites, and harriers	Bald eagle found in coastal areas in Atlantic Program Area; prey on fish, ducks, small mammals, and carrion. Nest in Atlantic Program Area and found there year-round.
Kingfishers	Relatively small birds that plunge-dive for fish in sheltered waters, including coastal bays and marshes. Nest in Atlantic Program Area and found there year-round.
Wrens	Marsh wren are secretive and breed in cattail marshes along coast. Found in Atlantic Program Area year-round.
Sparrows	Salt marsh, seaside, and Nelson's sparrows (respectively, *Ammodramus phoeniceus*, *A. maritimus*, and *A. nelsoni*) are obligate salt marsh-breeding birds. Found in salt marshes throughout Atlantic Program Area year-round.
Blackbirds and grackles	Red-winged blackbird (*Agelaius phoeniceus*) and boat-tailed grackle (*Quiscalus major*) nest in coastal salt marshes in Atlantic Program Area; found there year-round.

7.3.1. Listed Species

Several bird species within the Mid- Atlantic Program Area are identified as endangered and threatened in the states of Virginia and North Carolina, under the Virginia Endangered Species Act (Section 29.1-564 through 570, Code of Virginia) and North Carolina State Endangered Species Act (G.S. 113-331 to 113-337), respectively. In addition, several bird species that occur on or near the coasts of South Carolina and Georgia adjacent to the South Atlantic Program Area are identified as endangered or threatened, under the South Carolina Nongame and Endangered Species Conservation Act of 1973, and the Georgia Endangered Wildlife Act of 1973, respectively. Under the federal ESA, five species of marine and coastal birds that are listed as endangered or threatened occur in this region: wood stork (77 FR 75947), piping plover (50 FR 50726), Bermuda petrel (*Pterodroma cahow*) (35 FR 6069), red knot (79 FR 73705), and roseate tern (52 FR 42064). **Table C-24** provides a list of coastal and marine birds that are federally or state-listed, and may be found in or adjacent to the Mid- and South Atlantic Planning Areas. Only the federally listed species are discussed further below.

Table C-24. Federally Listed Coastal and Marine Bird Species Occurring in the Mid- and South Atlantic Program Area.

Common Name	Scientific Name	Federal Status	State Status
Bald eagle	*Haliaeetus leucocephalus*	NL	NC (T)
Bermuda petrel (Cahow)	*Pterodroma cahow*	E	
Gull-billed tern	*Gelochelidon nilotica*	NL	NC (T)
Least tern	*Sterna antillarum*	NL	SC (T)
Piping plover	*Charadrius melodus*	T	NC (T)
Red knot	*Calidris canutus rufa*	T	
Whooping crane	*Grus americana*	EPNE	
Wilson's plover	*Charadrius wilsonia*	NL	SC (T); GA (T)
Roseate tern	*Sterna dougallii*	E	VA (E); NC (E)
Wood stork	*Mycteria americana*	T	NC (E)

[1]Based on USFWS protected resources (USDOI, USFWS, 2015) as of May 13, 2015; species listed by Virginia updated March 2013; species listed by North Carolina updated February 2014; by South Carolina updated June 11, 2014; species listed by Georgia updated December 23, 2014.
[2]Federal Status: Federally Endangered (E); Federally Threatened (T); Not Listed (NL); Experimental Population - Non Essential (EPNE)
[3]State Status: state abbreviation and listing status - Endangered (E); Threatened (T)

There are additional threatened and endangered species that occur in the coastal areas of the Mid- and South Atlantic Planning Areas, which extend outside of the Program Areas (e.g., red-cockaded woodpecker, Kirtland's warbler [*Setophaga kirtlandii*], and Bachman's warbler [*Vermivora backmanii*]); however, they either are not considered coastal or marine birds based on their reliance on more terrestrial habitats, or they are not documented by USFWS in the Program Area. Therefore, these species were not discussed further as they are not likely to be adversely affected by oil and gas activities. For the purposes of this document only the species listed as federally endangered or threatened and found in the Program Area will be discussed below.

Piping Plover (*Charadrius melodus*)

The piping plover (*Charadrius melodus*) is a small, migratory shorebird that breeds on beaches from Newfoundland to South Carolina, and winters along the Atlantic Coast from North Carolina to the south, along the coast of the Gulf of Mexico, and in the Caribbean (USDOI, USFWS, 1996; Elliot-Smith and Haig, 2004). According to USFWS (USDOI, USFWS, 2009), piping plover breeding on the Atlantic Coast belong to the subspecies *C. melodus melodus*. This population is threatened, whereas other populations of piping plover that inhabit the Northern Great Plains and Great Lakes Watershed are endangered (USDOI, USFWS, 2015k). The most recent abundance projections estimate approximately 1,762 nesting pairs in 2011 (USDOI, USFWS, 2012).

The USFWS first designated critical habitat for the wintering population of piping plover in 142 areas along the coasts of North Carolina, South Carolina, Georgia, Florida, Alabama, Mississippi, Louisiana, and Texas on July 10, 2001 (66 FR 132). Critical habitat areas subsequently were revised in North Carolina in 2008 (73 FR 204) and in Texas in 2009 (74 FR 95). **Figures C-56a, C-56b**, and **C-57** map the species range and its modeled distribution (USDOI, USGS, 2013).

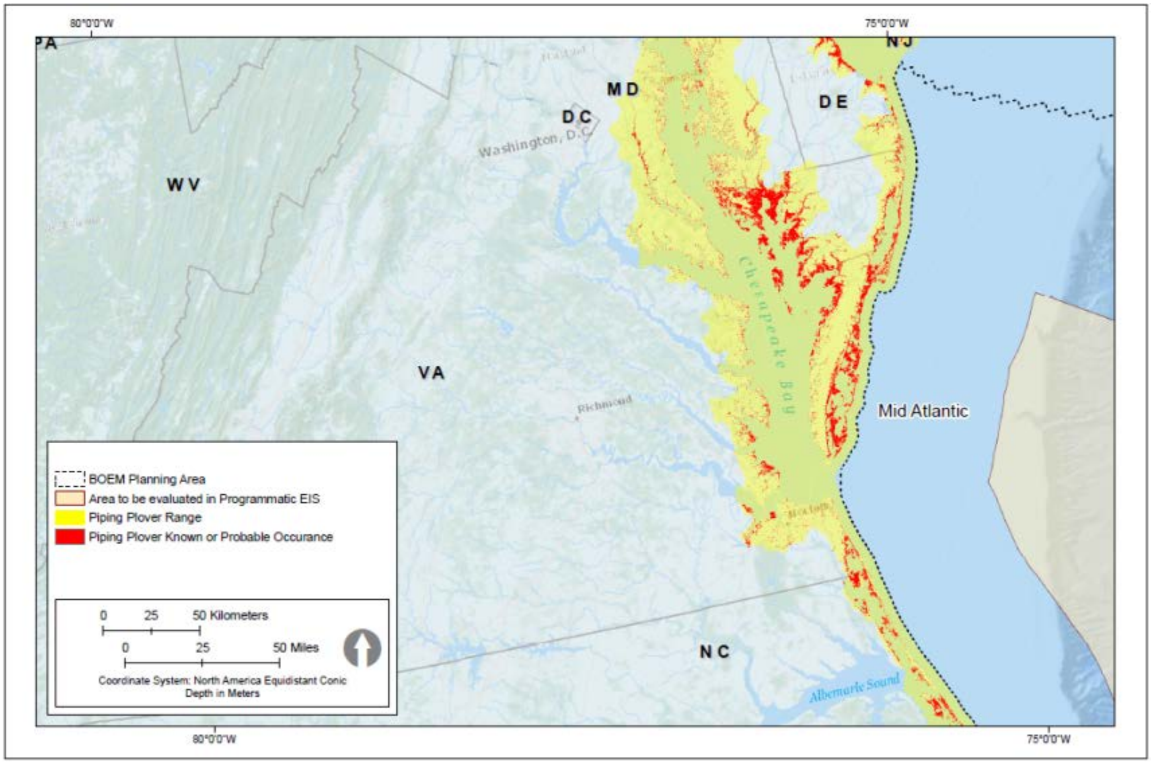


Figure C-56a. Range and Distribution of the Piping Plover Adjacent to the Mid-Atlantic Program Area (1 of 2).

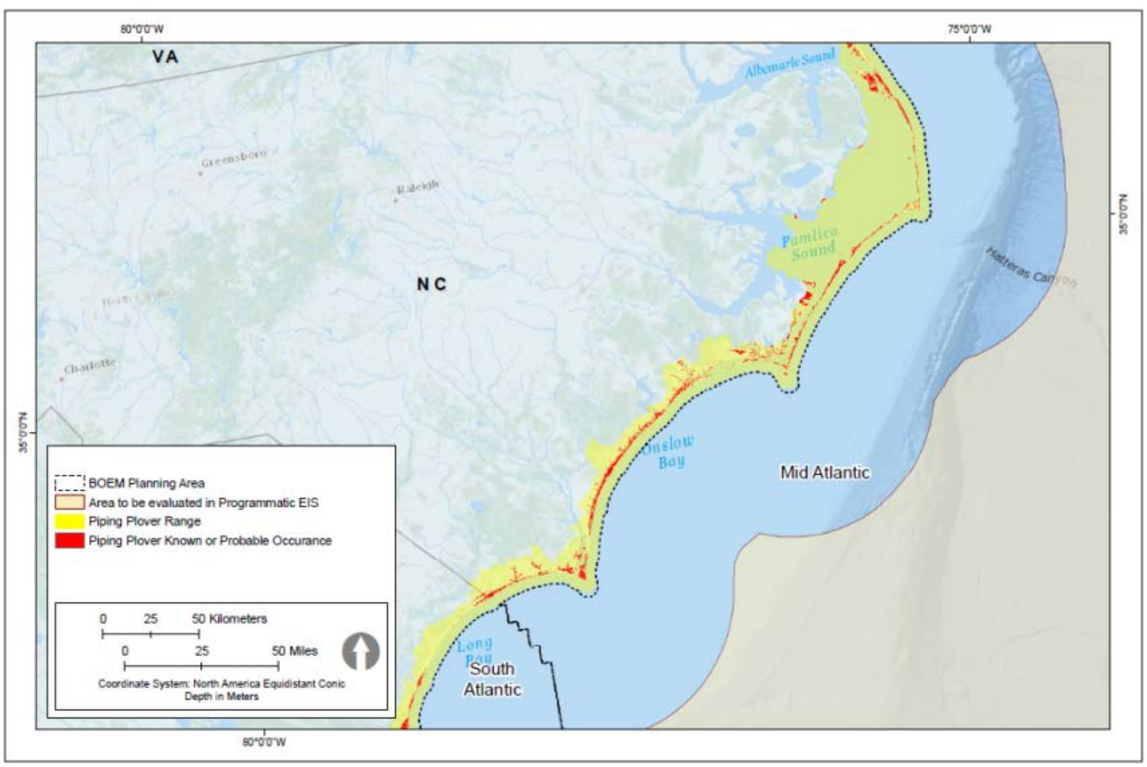


Figure C-56b. Range and Distribution of the Piping Plover Adjacent to the Mid-Atlantic Program Area (2 of 2).

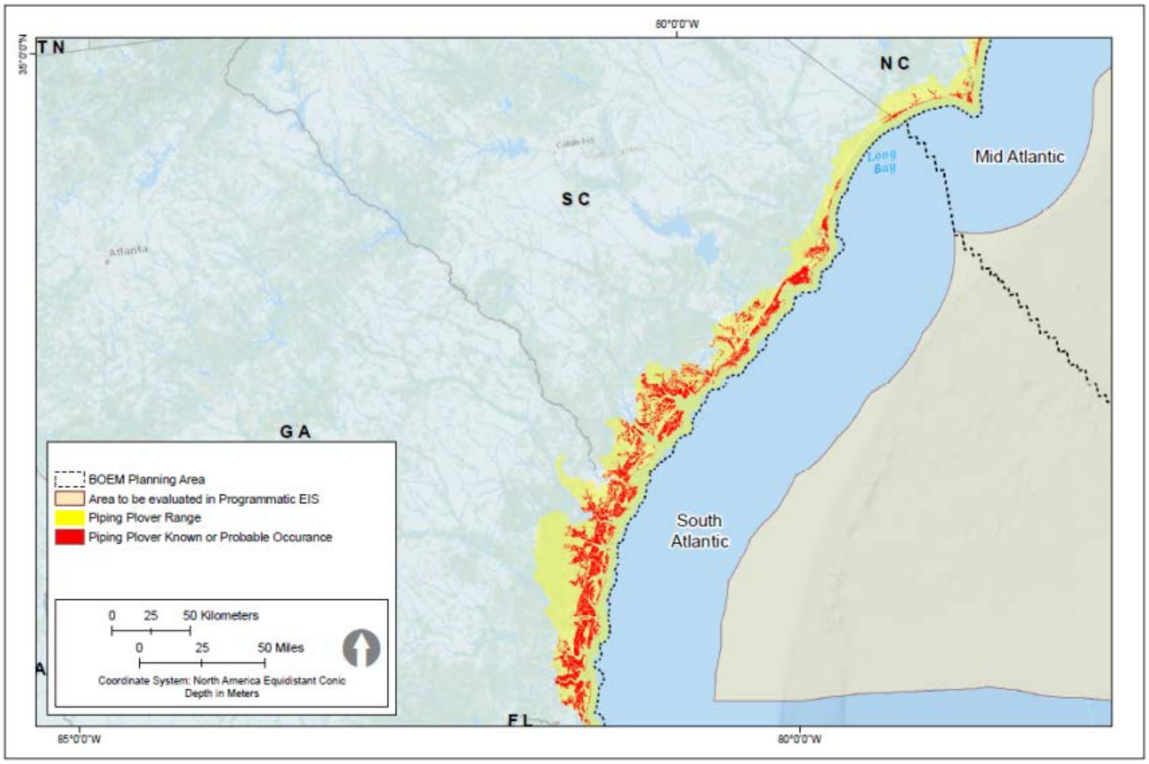


Figure C-57. Range and Distribution of the Piping Plover Adjacent to the South Atlantic Planning Area.

Piping plovers inhabit coastal sandy beaches and mudflats. They use open, sandy beaches close to the primary dune of the barrier islands for breeding, preferring sparsely vegetated open sand, gravel, or cobble for a nest site. They feed on marine worms, fly larvae, beetles, insects, crustaceans, mollusks, and other small invertebrates. They forage along the wrack zone, or wrack line, where dead or dying seaweed, marsh grass, and other debris is left on the upper beach by the high tide (USDOI, USFWS, 2015k).

A key threat to the Atlantic coast population is habitat loss resulting from shoreline development (USDOI, USFWS, 1996). Piping plover are very sensitive to human activities, and disturbances from anthropogenic activities can cause parent birds to abandon their nests. Since this species was listed under the ESA in 1986, the Atlantic coast piping plover population has increased 234 percent (USDOI, USFWS, 2009). Although increased abundance has reduced near-term vulnerability to extinction, piping plover remain sparsely distributed across their Atlantic coast breeding range, and populations are highly vulnerable to even small declines in survival rates of adults and fledged juveniles (USDOI, USFWS, 2009).

Roseate Tern (*Sterna dougallii*)

The roseate tern (*Sterna dougallii*) is a worldwide species that is divided into five subspecies. The Atlantic subspecies (*S. dougallii dougallii*) breeds in two discrete areas in the Western Hemisphere (USDOI, USFWS, 1998). The northeastern population, which is endangered, breeds from New York north to Maine and into adjacent areas of Canada. Historically this population bred as far south as Virginia; however the southern extent is now New York (USDOI, USFWS, 2015f). The most recent abundance estimate for the northeastern population is approximately 3,200 nesting pairs (Nisbet et al., 2014). A second population breeds on islands around the Caribbean Sea from the Florida Keys to the Lesser Antilles; this population, which is listed as threatened, also occurs along the U.S. southeast coast, where there are occasional breeding records from North Carolina, South Carolina, and Georgia (USDOI, USFWS, 2015f). **Figures C-58a** and **C-58b** provide species average annual abundance based on offshore survey data (USDOC, NOAA, 2014).

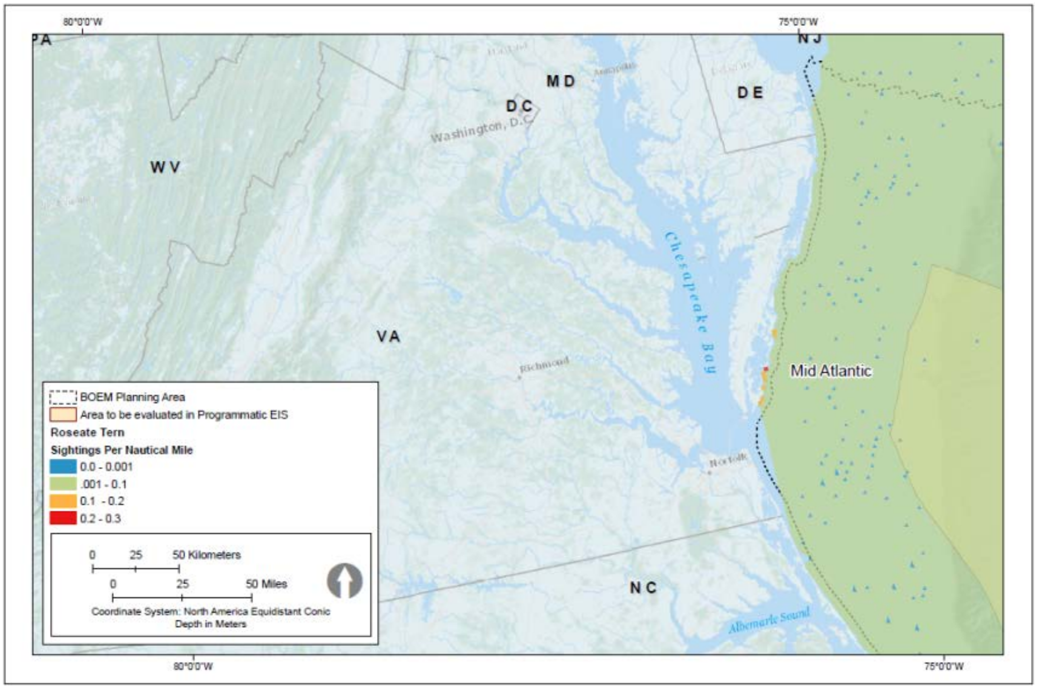


Figure C-58a. Annual Average Abundance of the Roseate Tern and the Mid-Atlantic Planning Area (1 of 2).

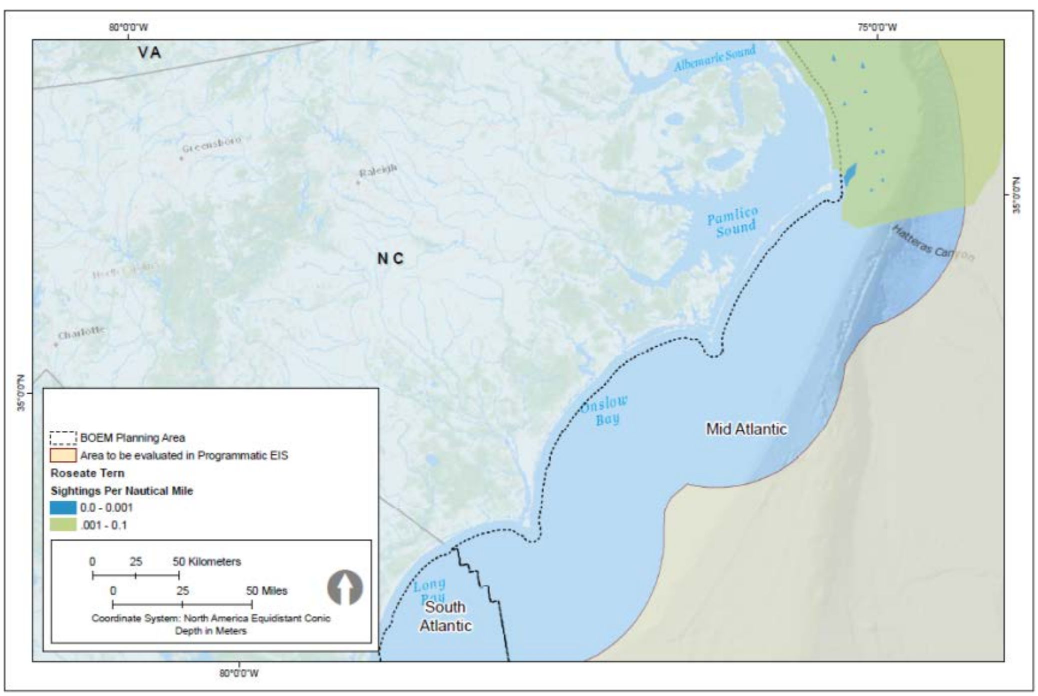


Figure C-58b. Annual Average Abundance of the Roseate Tern and the Mid-Atlantic Planning Area (2 of 2).

A description of the roseate tern is presented in **Section 7.2.1**, including comments about its preferred habitats, foraging, flight, and diving characteristics. Reasons that the roseate tern was initially listed also are discussed there, including loss of breeding sites, and population declines (USDOI, USFWS, 1998). Breeding colony loss has largely been attributed to predation. No critical habitat has been designated for the roseate tern on coasts adjacent to the Mid-Atlantic Planning Area.

Red Knot (*Calidris canutus rufa*)

The red knot is a medium-sized shorebird, added to the list of threatened species under the ESA in December 2014 (79 FR 73705). The listing became effective on January 15, 2015. Along the mid-Atlantic and southeastern U.S. coasts, red knots forage along sandy beaches, tidal mudflats, salt marshes, and peat banks (USDOI, USFWS, 2010b). In Delaware Bay, they feed primarily on horseshoe crab eggs, and the timing of their arrival within the bay typically coincides with the annual peak of the horseshoe crab spawning period (USDOI, USFWS, 2010b).

As described in **Section 7.2.1**, red knot migrate in large flocks from their breeding grounds in the mid- and high-Arctic, and their wintering grounds in southern South America (Harrington, 2001; Morrison et al., 2001; USDOI, USFWS, 2010b; Normandeau Associates, Inc., 2011). The northward migration through the contiguous U.S. occurs between April and June, and the southward migration between July and October. Delaware Bay is the most important spring migration stopover in the eastern U.S. because it is the final refueling point before the nonstop leg to the Arctic (Harrington, 2001; USDOI, USFWS, 2010b; NatureServe, 2015). Red knots arrive at the Delaware Bay stopover with body reserves completely depleted, and sometime emaciated, requiring readily available, easily digestible food such as juvenile clams and mussels as well as horseshoe crab eggs (USDOI, USFWS, 2014). Approximately 90 percent of the entire red knot population can be present in Delaware Bay in a single day (Cornell Lab of Ornithology, 2015).

Their migratory habits make estimating the range-wide population of red knot challenging. A population estimate is further complicated by the different survey methods that have been used across the red knot range. Survey counts in the mid-Atlantic estimate 48,955 red knot stopped in Delaware Bay in 2013, with 5,547 to 8,482 red knots stopping in Virginia each year between 2011 and 2014 (USDOI, USFWS, 2014d). **Figures C-59a**, **C-59b,** and **C-60** map red knot range and modeled distribution (USDOI, USGS, 2013).

Surveys of wintering red knots along the coasts of southern Chile and Argentina, and during spring migration through Delaware Bay indicate that a serious population decline occurred in the 2000s (USDOI, USFWS, 2014). The primary threat to the red knot has been attributed to reduction in key food resources as a result of a reduced number of horseshoe crabs, harvested primarily for use as bait, and secondarily to support a biomedical industry (USDOI, USFWS, 2003; USDOI, USFWS, 2010b). Other identified threats to the red knot population are identified in **Section 7.2.1**.

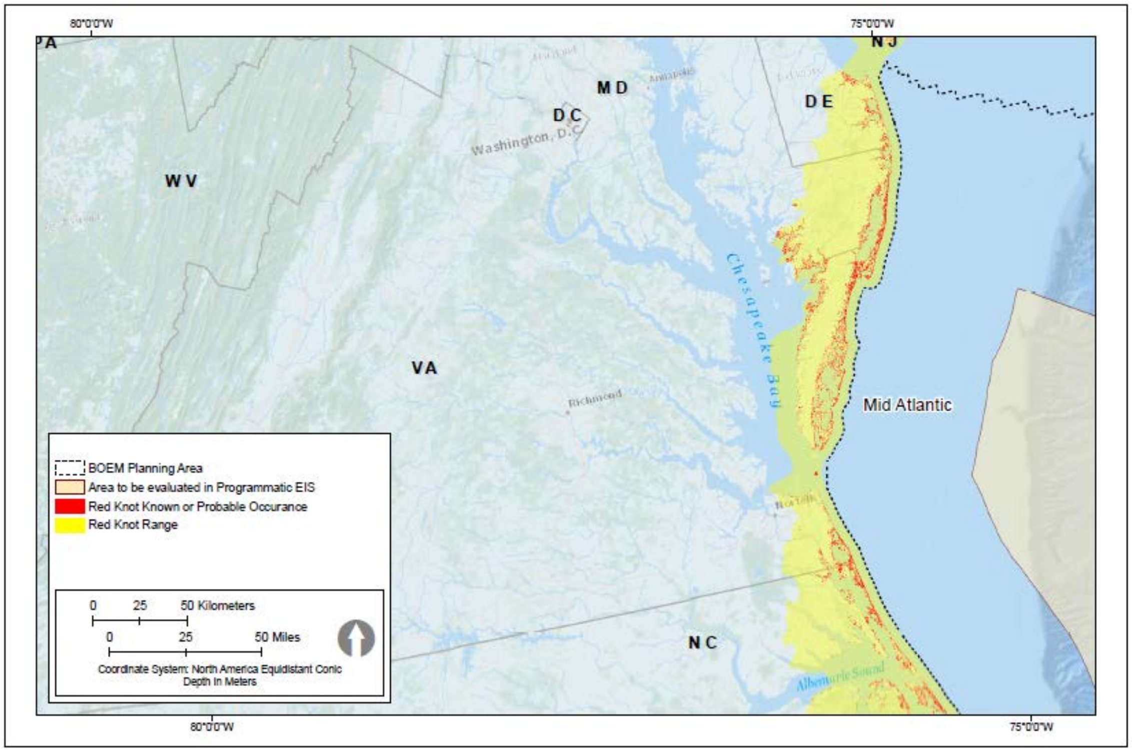


Figure C-59a. Range and Distribution of the Red Knot Adjacent to the Mid-Atlantic Program Area (1 of 2).

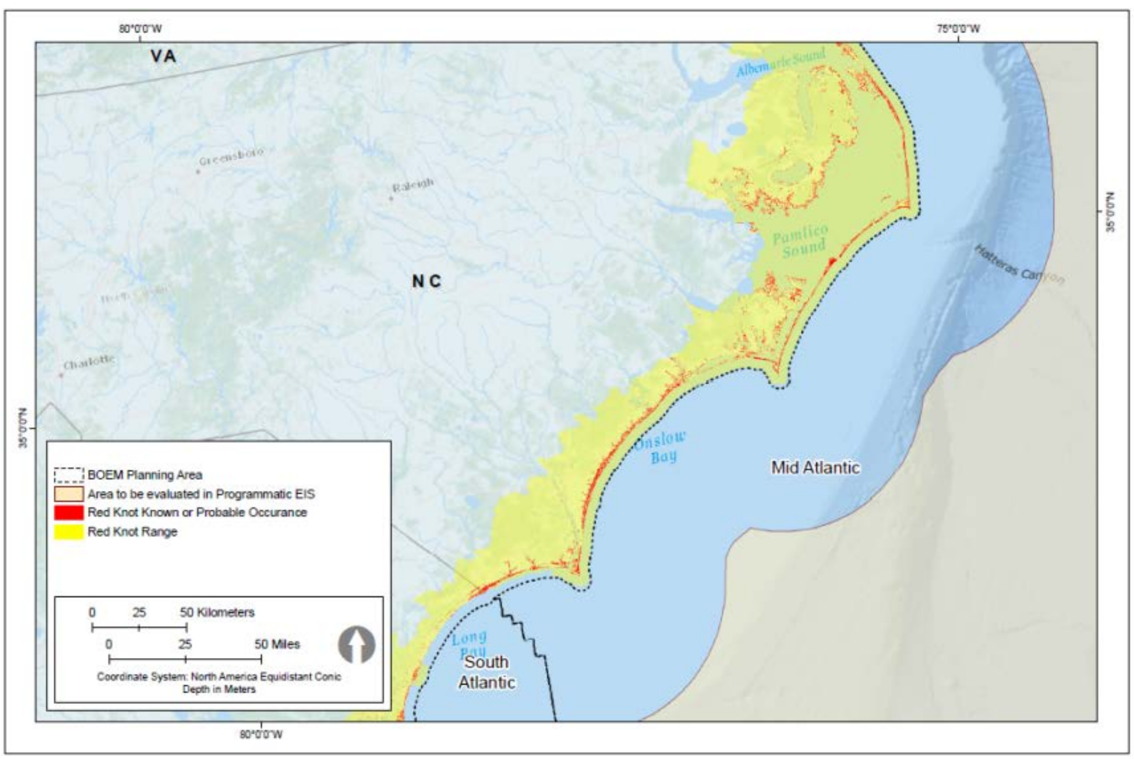


Figure C-59b. Range and Distribution of the Red Knot Adjacent to the Mid-Atlantic Program Area (2 of 2).

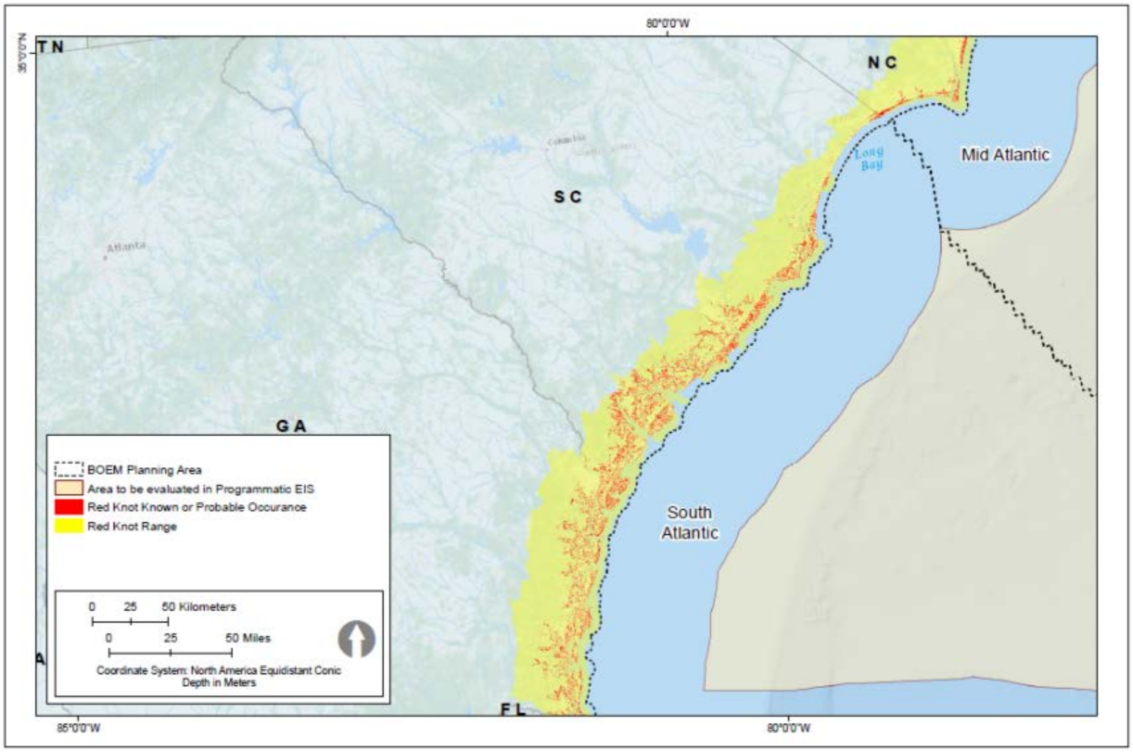


Figure C-60. Range and Distribution of the Red Knot Adjacent to the South Atlantic Program Area.

Bermuda Petrel (*Pterodroma cahow*)

The Bermuda petrel, or cahow is a member of the "gadfly petrel" group (Genera *Lugensa* and *Pterodroma*), which are highly pelagic birds widespread in tropical and subtropical seas (Warham, 1990). This species was initially listed by USFWS as endangered in 1970 (USDOI, USFWS, 2015i). Successful conservation efforts have increased the population, but it remains listed as endangered (72 FR 54057). The overall population status of the Bermuda petrel is unknown due to its range and distribution at sea; however, studies in 2011-2012 estimated 101 breeding pairs (Madeiros, 2012).

The Bermuda petrel is endemic to Bermuda and breeds there on rocky inlets in Castle Harbour between October and June (Warham, 1990; Onley and Scofield, 2007). Its distribution outside of the breeding season is poorly known, though the species is probably far-ranging in the North Atlantic, following the warm waters on the western edge of the Gulf Stream. There are confirmed sightings of Bermuda petrel offshore of North Carolina (Lee, 1984, 1987). However, no reliable distribution data are available for Bermuda petrel within the Mid- and South Atlantic Program Areas.

The Bermuda petrel and other gadfly petrels are usually colonial when breeding, but are often solitary at sea, feeding within oceanic waters on surface and near-surface prey. They are extremely aerial birds and so rarely land on the sea and only return to land to breed (Warham, 1990; Wingate, 1973). Bermuda petrel feed by snatching food by "dipping" or by scavenging dead or dying prey floating on or near the sea surface (Warham, 1990). They and other gadfly petrels are known to feed at night primarily on squids, but also on fishes and invertebrates to a lesser degree (Warham, 1996).

Exploitation of nesting Bermuda petrel by early colonists and predation by introduced mammals decimated their numbers to the point where the species was thought to be extinct. In 1951 eighteen breeding pairs were rediscovered and the Government of Bermuda implemented a conservation plan to protect the Bermuda petrel. Currently the primary threats to the Bermuda petrel include damage to nesting islets by storm events and SLR (USDOI, USFWS, 2015i).

Wood Stork (*Mycteria Americana*)

The wood stork is a large wading bird with white plumage except for dark primaries and secondaries, and a dark unfeather head and bill. Wood stork are one of seventeen species of true storks and the only stork that regularly occurs in the U.S. (USDOI, USFWS, 2007b). The wood stork was first listed under the ESA in 1984 as endangered, but was reclassified in 2014 as threatened based on improvements between 2001 and 2013 in the breeding population to an estimated average of 9,692 nesting pairs (79 FR 37077).

The southeast breeding range includes peninsular Florida, the coastal plain and large river systems of Georgia and South Carolina, and now extends north into southern North Carolina, indicating a northern geographic expansion (USDOI, USFWS, 2007). Wood stork frequently build their nests in large cypress trees and mangroves; however they also have been known to build nests in dead hardwood trees. Nesting periods vary geographically. In their southern U.S. extent, wood stork lay eggs as early as October and fledge in February or March. In their central and northern extents, wood stork lay eggs from March to late May, and fledge in July and August (USDOI, USFWS, 2015m). **Figures C-61** and **C-62** map wood stork range and modeled distribution (USDOI, USGS, 2013).

Wood stork primarily prey on small fish utilizing a specialized technique known as grope-feeding, which involves the stork wading through shallow water, and moving its open bill through the water until prey triggers a rapid reflexive closure of the bill. Because this feeding technique relies on reflex, the stork can feed in dark or murky water where sighting prey may be impossible. This feeding behavior relies on optimal water regimes involving periods of flooding, during which prey populations increase, alternating with dryer periods, during which receding water levels concentrate fish at higher densities coinciding with the stork's nesting season (USDOI, USFWS, 2015m).

Originally the wood stork was added to the ESA list due to a reduction in food base necessary to support breeding colonies, attributed to loss of wetland habitat, as well as to changes in water hydroperiods due to human alteration and development (USDOI, USFWS, 2015m). These impacts remain the primary threat to the species, as well as prolonged drought and flooding, raccoon predation on nests, and human disturbance of rookeries (USDOI, USFWS, 2015m).

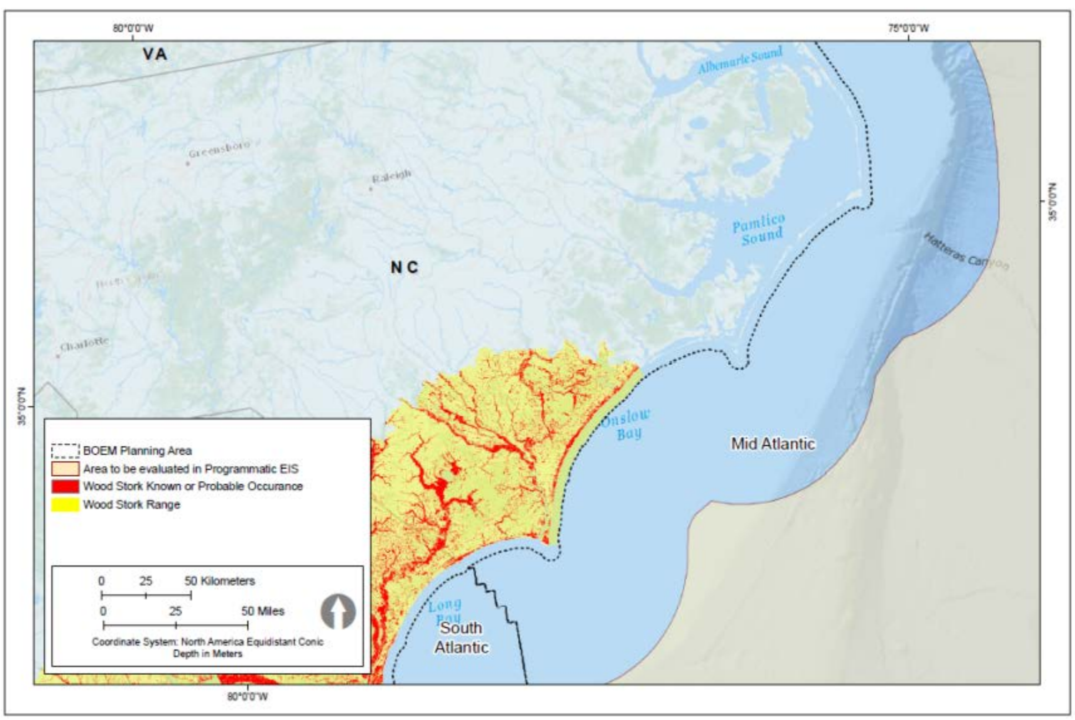


Figure C-61. Range and Distribution of the Word Stork Adjacent to the Mid-Atlantic Program Area.

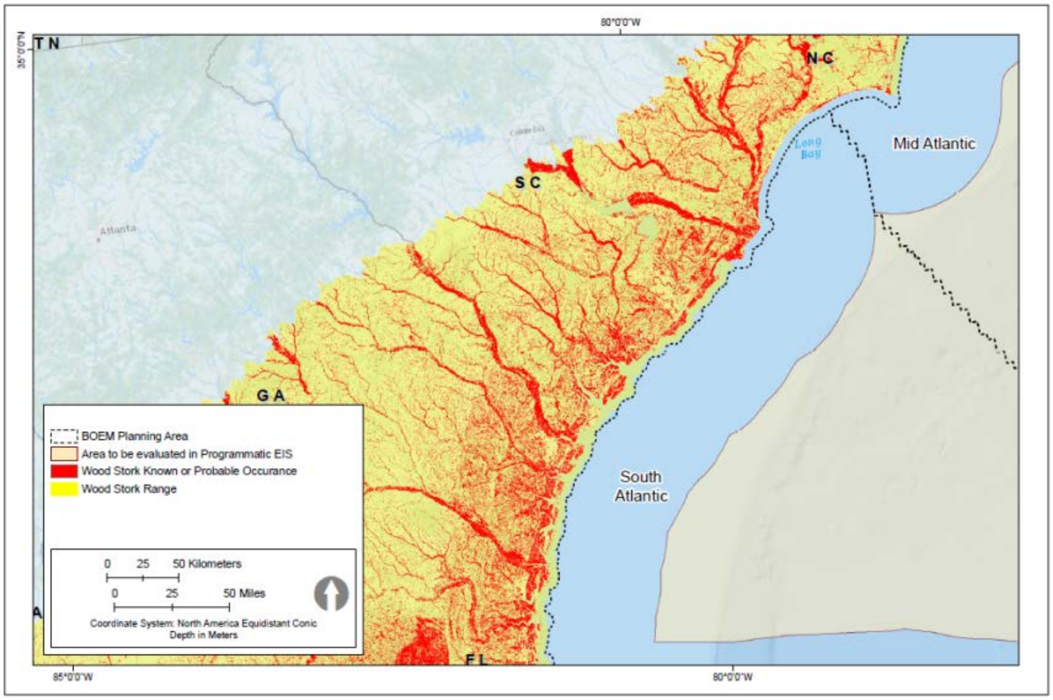


Figure C-62. Range and Distribution of the Wood Stork Adjacent to the South Atlantic Program Area.

7.3.2. Candidate Species and Species of Concern

No federal candidate species have been identified for the Mid- and South Atlantic Program Area.

7.3.3. Migration

All native migratory birds found in the Mid- and South Atlantic Program Area, including the federally listed coastal and marine birds, and their eggs, are protected from lethal take under the Migratory Bird Treaty Act. Many terrestrial, coastal and marine birds use the Atlantic Flyway for migration. The Atlantic Flyway extends from the offshore waters of the Atlantic Coast west to the Allegheny Mountains, and then across the prairie provinces of Canada and the Northwest Territories to the Arctic coast of Alaska. The coastal route of this flyway originates in the eastern Arctic islands and the coast of Greenland, and generally follows the shoreline along the Atlantic Coast (North American Migration Flyways, 2015; Brown et al., 2001; Morrison et al., 2001). Disturbance along the shoreline where migrating birds forage can cause them to have additional energy requirements (Helmers, 1992).

There is an additional migratory route, the North Atlantic or Shorebird Flyway that is exclusively oceanic and passes directly over the Atlantic Ocean from Labrador and Nova Scotia to the Lesser Antilles, continuing on to South America (Rappole, 1995). This route is followed by thousands of birds, including some shorebirds that nest on the Arctic tundra; these fly across Canada to the Atlantic Coast, and follow this oceanic course to South America (North American Migration Flyways, 2015; Morrison et al., 2001).

7.3.4. Bird Conservation Regions and Birds of Conservation Concern

There are two BCRs located adjacent to the Mid- and South Atlantic Program Areas: BCR 27, the Southeastern Coastal Plain and BCR 30, the New England/Mid-Atlantic Coast (**Figures C-63** and **C-64**) (U.S. NABCI Committee, 2000). Tables 25 and 28 in USDOI, USFWS (2008) include 62 bird species of conservation concern potentially present in these BCRs, excluding red knot, which only recently has been listed.

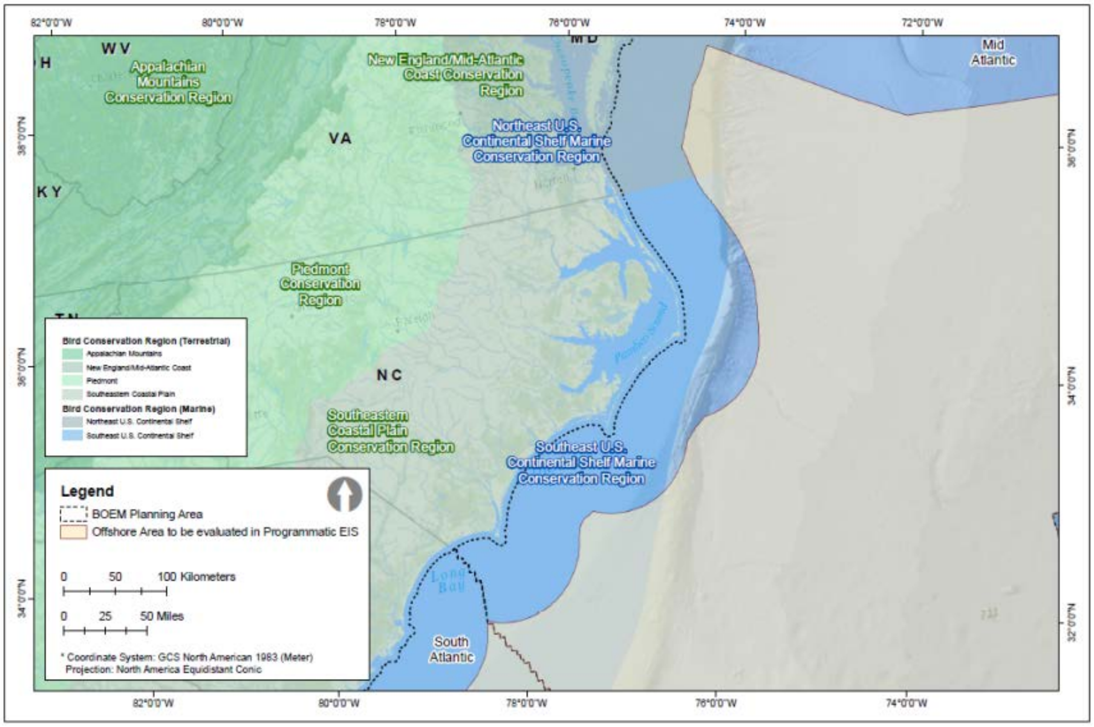


Figure C-63. Bird Conservation Regions Located in the Vicinity of the Mid-Atlantic Program Area.

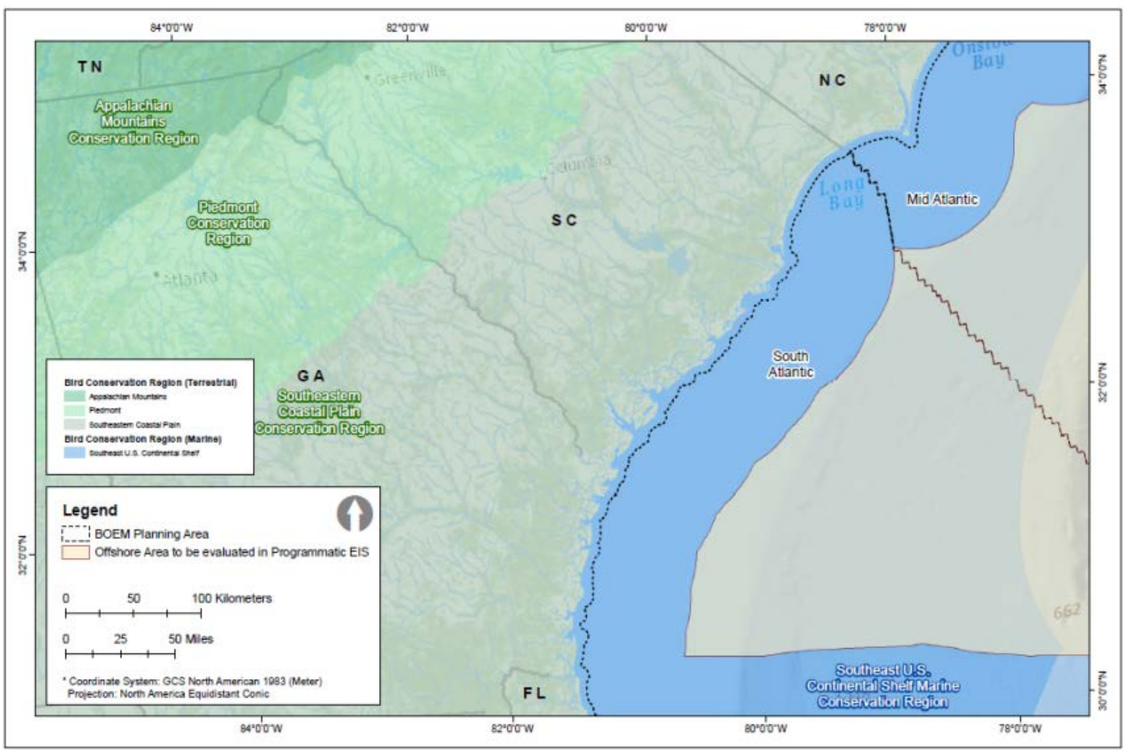


Figure C-64. Bird Conservation Regions Located in the Vicinity of the South Atlantic Program Area.

7.3.5. Important Bird Areas

The globally important Mid- and South Atlantic IBA sites designated along the coast, in nearshore waters, or offshore are listed in **Table C-25** and shown in **Figures C-65a, C-65b**, and **C-66**. Two are in Virginia, fifteen in North Carolina, four in South Carolina, and three in Georgia.

Table C-25. Important Bird Areas Identified under the National Audubon Society IBA Program in or Adjacent to the Mid- and South Atlantic Program Areas.

State	IBA Name
Virginia	Barrier Island/Lagoon System
	Delmarva Bayside Marshes
North Carolina	Outer Banks Inshore Ocean
	Currituck Marshes - Pine Island
	Cape Hatteras National Seashore
	Alligator River Lowlands
	Pea Island National Wildlife Refuge
	Outer Continental Shelf
	Lake Mattamuskeet - Swan Quarter
	Big Foot Island
	Cape Lookout National Seashore
	Raccoon Island
	Carrot Island - Bird Shoal
	Sand Bag Island
	Lea-Hutaff Island
	Bald Head - Smith Island
	Battery Island
South Carolina	Hobcaw Barony
	ACE Basin National Wildlife Refuge - Edisto Unit
	Bear Island Wildlife Management Area
	Deveaux Bank
Georgia	Altamaha River Delta
	Altamaha Waterfowl Management Area
	Cumberland Island National Seashore

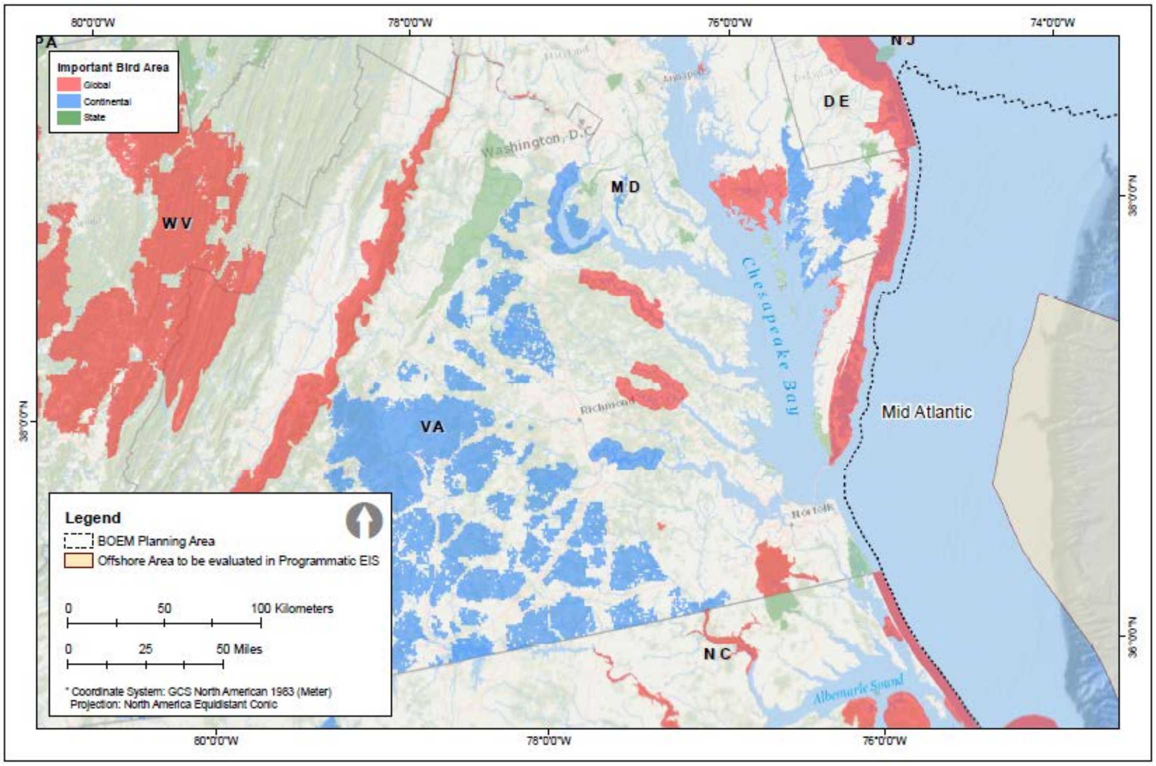


Figure C-65a. Important Bird Areas Identified under the National Audubon Society IBA Program (2015) in or Adjacent to the Mid-Atlantic Program Area (1 of 2).

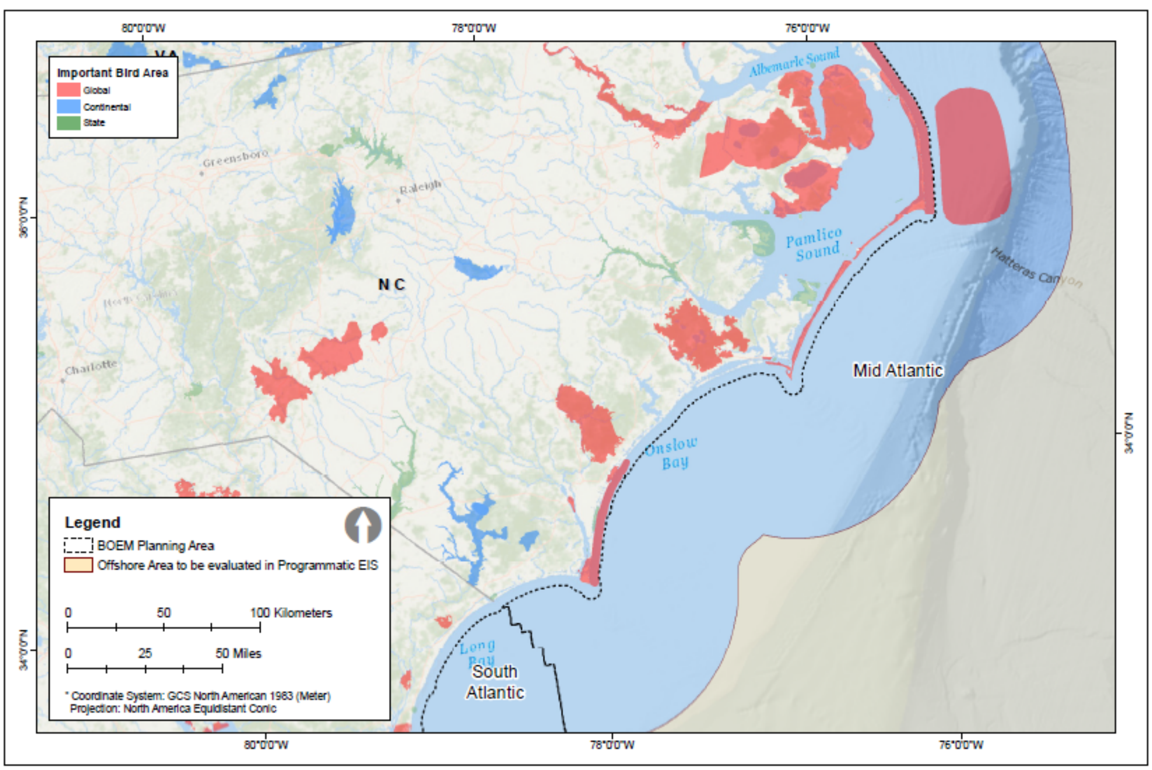


Figure C-65b. Important Bird Areas Identified under the National Audubon Society IBA Program (2015) in or Adjacent to the Mid-Atlantic Program Area (2 of 2).

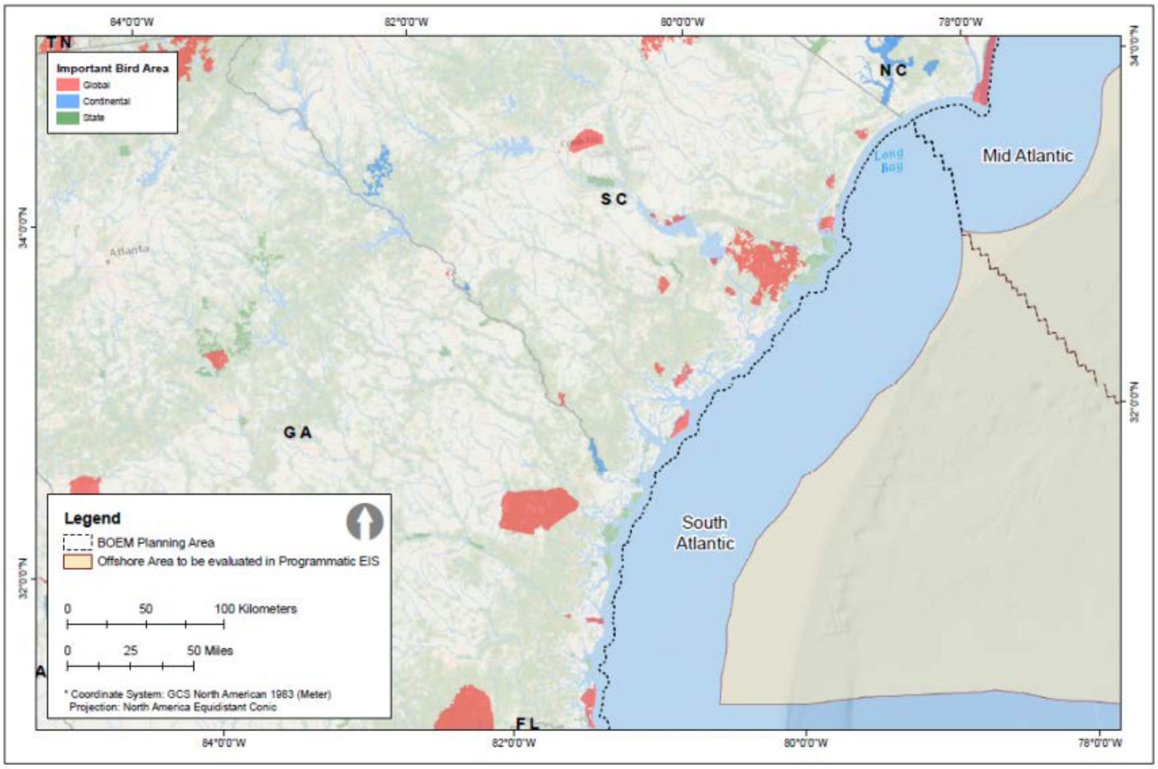


Figure C-66. Important Bird Areas Identified under the National Audubon Society IBA Program (2015) in or Adjacent to the South Atlantic Program Area.

8.0. FISHES AND ESSENTIAL FISH HABITAT

The Magnuson-Stevens Fishery Conservation and Management Act (16 U.S.C. § 1801-1882) established regional Fisheries Management Councils (FMCs) and mandated that FMPs be developed to responsibly manage exploited fish and invertebrate species in U.S. federal waters. When Congress reauthorized this Act in 1996 as the Sustainable Fisheries Act (SFA), several reforms and changes were made. One change was to charge NMFS with designating and conserving essential fish habitat (EFH) for species managed under existing FMPs. This is intended to minimize, to the extent practicable, any adverse effects on habitat caused by fishing or non-fishing activities, and to identify other actions to encourage the conservation and enhancement of such habitat.

EFH is defined as "those waters and substrate necessary to fish for spawning, breeding, feeding or growth to maturity" [16 U.S.C. § 1801(10)]. The EFH final rule summarizing EFH regulation (50 CFR part 600) outlines additional interpretation of the EFH definition. Waters, as defined previously, include "aquatic areas and their associated physical, chemical, and biological properties that are used by fish, and may include aquatic areas historically used by fish where appropriate." Substrate includes "sediment, hard bottom, structures underlying the waters, and associated biological communities." Necessary is defined as "the habitat required to support a sustainable fishery and the managed species' contribution to a healthy ecosystem." "Fish" includes "finfish, mollusks, crustaceans, and all other forms of marine animal and plant life other than marine mammals and birds," whereas "spawning, breeding, feeding or growth to maturity" covers the complete life cycle of those species of interest.

8.1. ALASKA PROGRAM AREAS

8.1.1. Essential Fish Habitat

8.1.1.1. Beaufort Sea and Chukchi Sea Planning Areas

This section discusses managed species and EFH within the Beaufort Sea and Chukchi Sea Planning Areas (Figure 2.1-1 in the Programmatic EIS). The Beaufort Sea and Chukchi Sea Planning Areas are grouped and managed under two FMPs:

- FMP for the Arctic Management Area (Arctic FMP, 2009; North Pacific Fisheries Management Council [NPFMC], 2009); and,
- FMP for the Salmon Fisheries in the EEZ off Alaska (NPFMC; USDOC, NMFS; and ADFG, 2012).

The Arctic FMP encompasses all marine waters in the U.S. EEZ (3 nmi [5.6. km] from shore out to 200 nmi [370 km]) within the Beaufort and Chukchi Seas; with the western boundary on the Chukchi Sea, demarcated by the 1990 U.S./Russia maritime boundary line, and the eastern boundary extending to the U.S./Canada maritime boundary bisecting the Beaufort Sea (NPFMC, 2009).

The Arctic FMP governs commercial fishing for all stocks of finfish and shellfish in federal waters, except for Pacific salmon and Pacific halibut (*Hippoglossus stenolepis*). These species are managed under the salmon FMP and the International Pacific Halibut Commission, respectively (NPFMC and USDOC, NMFS, 1990).

Based on research by NMFS, the findings of the FMP, and the fact that most fishing within Beaufort and Chukchi Seas occurs within Alaskan waters, the Arctic Management Area (Beaufort and Chukchi Seas) is closed to commercial fishing (NPFMC, 2009). As regulated by the Arctic Fisheries Management Council and NMFS there has been no new information indicating that commercial fisheries could be supported in the Arctic Ocean and no reason to initiate a planning process for commercial fishery development (NPFMC, 2009). Although species managed under separate FMPs such as salmon, groundfish, halibut, crabs, and scallops are present in Arctic waters, their commercial harvests are not permitted in the Beaufort Sea and Chukchi Sea Planning Areas (NPFMC, 2009). The Arctic FMP, EFH has been designated for various stages of the three species listed below in **Table C-26** (NPFMC, 2009).

Table C-26. Beaufort and Chukchi Seas (Arctic Ocean) Finfish and Shellfish Species with EFH Described in the Arctic FMP (Modified from: NPFMC, 2009).

Common Name	Scientific Name	Life Stage				
		Egg	Larval	Early Juvenile	Late Juvenile	Adult
Arctic cod	*Boreogadus saida*	–	–	–	✓	✓
Saffron cod	*Eleginus gracilis*	–	–	–	✓	✓
Snow crab	*Chionoecetes opilio*	✓	–	–	✓	✓

Arctic Cod (*Boreogadus saida*)

The FMPs for Arctic cod have not been updated since the release of the 2012-2017 Programmatic EIS (USDOI, BOEM, 2012) to determine the EFH for the presence or utilization of eggs, larvae, and early juvenile life stages. For late juveniles and adults, EFH includes pelagic waters, 0 to 200 m (0 to 656 ft), and epipelagic Arctic waters and upper slope waters from 200 to 500 m (656 to 1,640 ft). The 2012-2017 Programmatic EIS did state that Arctic cod has been reported to spawn under ice during winter (Parker-Stetter et al., 2011; USDOI, BOEM, 2015).

Saffron Cod (*Eleginus gracilis*)

The FMPs for saffron cod have not been updated since the release of the 2012-2017 Programmatic EIS (USDOI, BOEM, 2012) to determine the EFH for the presence or utilization of eggs, larvae, and early juvenile life stages. The EFH for late juveniles and adults includes coastal pelagic and epipelagic Arctic waters from 0 to 50 m (0 to 164 ft), and wherever there are sand and gravel substrates.

Snow Crab (*Chionoecetes opilio*)

The defined EFH for snow crab is shown in **Figure C-67**. EFH for eggs, late juveniles, and adult snow crab consists of bottom habitats along the inner shelf from 0 to 50 m (0 to 164 ft), and the middle shelf from 50 to 100 m (164 to 328 ft), in Arctic waters south of Cape Lisburne, wherever there are substrates consisting mainly of mud. EFH for the larvae and early juveniles has not been identified for the snow crab.

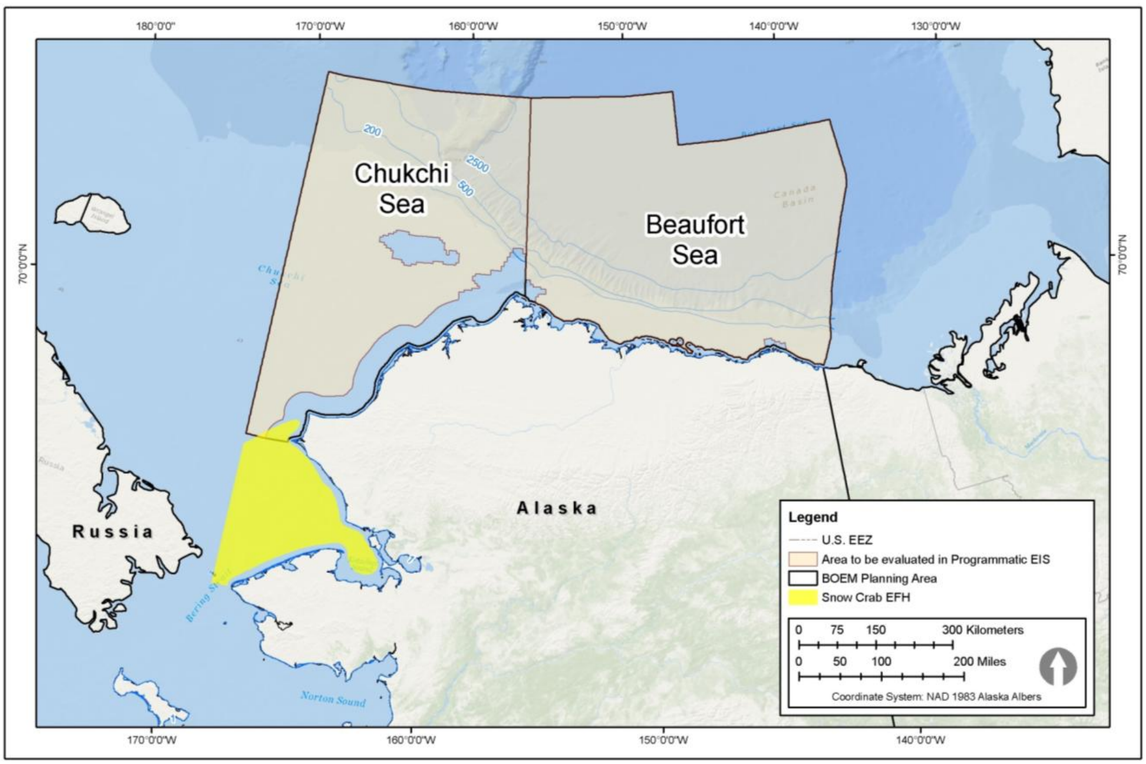


Figure C-67. EFH for Snow Crab Within the Bering Strait and Chukchi Sea (From: NPFMC, 2014).

Salmon (*Oncorhynchus* spp.)

The FMP designates EFH for juvenile or adult marine life stages of five species of salmon regularly found within the waters of the Chukchi and Beaufort Sea (**Table C-26**) (NPFMC, 2012).

The five species of salmon are found in all marine waters of the Chukchi Sea and Arctic Ocean from the mean higher tide line to the 200 nmi (370.4 km) limit of the U.S. EEZ (NPFMC, 2012). There have been no Habitat Areas of Particular Concern (HAPCs) established within the Beaufort Sea and Chukchi Sea Planning Areas since the publication of the 2012-2017 Programmatic EIS (USDOI, BOEM, 2012). Commercial fishing on salmon in the Arctic Management Area is prohibited by 50 CFR 679.3(f)(4), as authorized by the Salmon FMP (NPFMC, 2012). As described in the 2012-2017 Programmatic EIS, all five managed salmon species decrease in abundance north of the Bering Strait (Craig and Haldorson, 1986; USDOI, BOEM, 2012) and from west to east along the coast of the Beaufort and Chukchi Seas.

Pink salmon (*Oncorhynchus nerka*) and chum salmon (*O. keta*) are most common in Arctic waters (Augerot, 2005; Stephenson, 2005; Moss et al., 2009; Kondzela et al., 2009). Salmon are most abundant west of Point Barrow and appear to be rare in the Beaufort Sea and extremely rare in the eastern Beaufort Sea, although chum salmon are natal to the Mackenzie River and consistently found there in low numbers (Irvine et al., 2009). Chum and pink salmon may be natal to other rivers on the North Slope; that possibility has not been confirmed (Irvine et al., 2009).

8.1.2.1. Cook Inlet Planning Area

The Program Area (Figure 2.1-1 in the Programmatic EIS) identified in this section includes the Upper Boundaries of Cook Inlet Alaska. The FMPs and the EFH environments for the managed species that occur in waters of the Upper Boundary of Cook Inlet are described below. Supporting EFH documents can be found in NMFS (2005) and NPFMC (2015a). Information describing the biology, ecology, and behavior of fish species normally found in the Cook Inlet can be found in previous sections of this document. Stock Assessment and Fishery Evaluation Reports that support the FMPs and fishing regulations within Cook Inlet are provided by the NMFS Alaska Fisheries Science Center (USDOC, NOAA, 2015c). A list of the FMPs applicable to Cook Inlet is listed below:

- Gulf of Alaska (GOA) Groundfish FMP;
- Scallop FMP; and,
- Salmon FMP.

The GOA Groundfish FMP (NPFMC, 2010) pertains to the area depicted in **Figure C-68**, comprising EEZ waters south and east of the Aleutian Islands at longitude 170° W, and of Dixon Entrance at longitude 132°40’ W, and includes the western, central, and eastern regulatory areas (North Pacific Fishery Management Council [NPFMC] [], 2015). The Gulf of Alaska Fisheries Management Plan (GOAFMP) covers all commercial finfish managed and harvested except Pacific salmon, steelhead trout, Pacific halibut , Pacific herring, and tuna (Scombridae) (NPFMC, 2015). Highly migratory species such as tuna are only found within the GOA during El Niño years and are not a designated target species in the GOA (NPFMC, 2015). Species taken within the groundfish fishery are broken into two main categories, Target Species and Ecosystem Components by the GOAFMP (NPFMC, 2015) and are presented and identified in the following;

- In the Fishery:
  - — Target Species: species that support a single species or mixed species target fishery, are commercially important, and for which a sufficient database exists that allows each to be managed on its own biological merits.

- Ecosystem Components:
  - — Prohibited Species: species and species groups the catch of which must be avoided while fishing for groundfish, and which must be immediately returned to the sea with a minimum of injury.
  - — Forage Fish Species: fish that are a critical food source for many marine mammal, seabird and fish species. The forage fish species category is established to allow for the management of these species in a manner that prevents the development of a commercial directed fishery for forage fish.

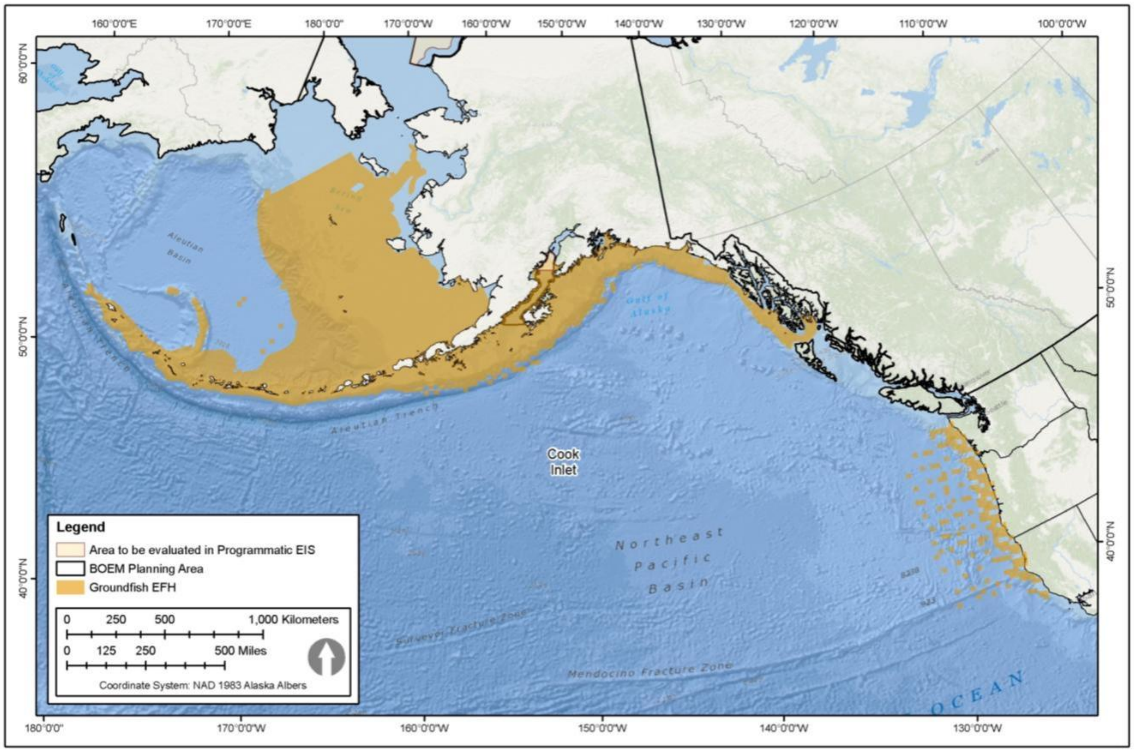


Figure C-68. EFH for the Species of Groundfish Commercially Harvested Within the Gulf of Alaska.

Species groups managed under the GOA Groundfish FMP are listed in **Table C-27**. EFH has been designated for almost all of the life stages for managed species. Habitats utilized by the groundfish target species are listed in the 2015 GOAFMP (NPFMC, 2015). The only groups that do not have designated EFH habitats for life stages include sharks, octopuses, and forage fish. Most if not all of the marine and aquatic habitats within the Cook Inlet Program Area have been identified as EFH to most of the groundfish target species during some stage of their life cycles. As identified in the 2012-2017 Programmatic EIS the most diverse species group within the GOA is the rockfish. This species group is represented by 39 species (Enticknap and Sheard, 2005). Most of the rockfish use one or more of the aquatic habitats within the Cook Inlet during some stage of their life cycle; these habitats include eel grass, estuaries; bays; kelp forests; reefs; and nearshore, coastal, continental shelf, oceanic, and bathypelagic waters and/or substrates (Enticknap and Sheard, 2005; NPFMC, 2015). Information on species-specific EFHs can be found in NPFMC (2010). Within the Cook Inlet non-pelagic trawling is prohibited by the GOAFMP in federal waters and by the ADFG (**Figure C-69**; NPFMC, 2015).

Table C-27. Species Included in the GOAFMP and Their Categories (Modified From: NPFMC, 2015).

In the Fishery
Target Species
Walleye pollock
Pacific cod
Sablefish
Flatfish: shallow-water flatfish, deepwater flatfish, rex sole, flathead sole, arrowtooth flounder
Rockfish: northern rockfish, shortraker, rougheye, rockfish, other slope rockfish, pelagic shelf rockfish, demersal shelf rockfish, thornyhead rockfish
Atka mackerel
Skates (big skates, longnose skates, and other skates)
Squid
Sculpin
Shark
Octopus
Ecological Components
Prohibited Species
Pacific halibut
Pacific herring
Pacific salmon
Steelhead trout
King crab
Tanner crab
Forage Fish Species
Osmeridae (eulachon, capelin, and other smelts)
Myctophidae (lanternfishes)
Bathylagidae (deepsea smelts)
Ammodytidae (Pacific sand lance)
Trichodontidae (Pacific sand fish)
Pholidae (gunnels)
Stichaeidae (pricklebacks, warbonnets, eelblennys, cockscombs, and
Gonostomatidae (bristlemouths, lightfishes, and anglemouths)
Order Euphausiacea (krill)

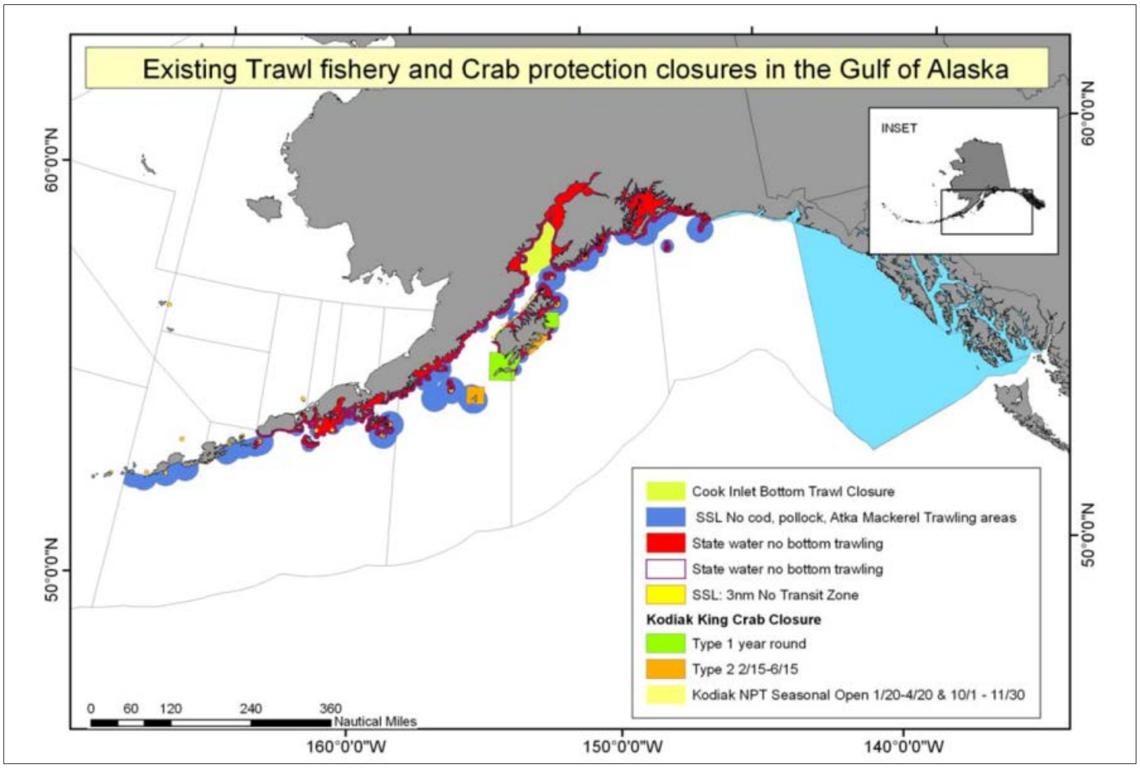


Figure C-69. Non-Pelagic Trawl Closure Areas Within Cook Inlet and the Gulf of Alaska (From: NPFMC, 2015b).

There are no HAPCs identified within Cook Inlet (NPFMC, 2015). The Alaska Seamount Habitat Protection Areas and Gulf of Alaska Coral Protection Areas are the closest designated HAPCs within the Alaskan EEZ and are located approximately 416 km (225 nmi) from the entrance of Cook Inlet.

Within the benthic habitat of Cook Inlet the only commercially viable species is the weathervane scallop (*Patinopecten caurinus*) and its habitat as defined in the 2014 Scallop FMP (NPFMC, 2014) and includes the federal waters of the GOA, Aleutian Islands, the Bering Sea, and most specifically within the lower portion of Cook Inlet (**Figure C-70**; NPFMC, 2014). As presented in the Scallop FMP (NPFMC, 2014), three other species of scallops are found with the same range:

- Pink scallop (*Chlamys rubida*);
- Spiny scallop (*Chlamys hastata*); and
- Rock scallop (Crassadoma gigantean).

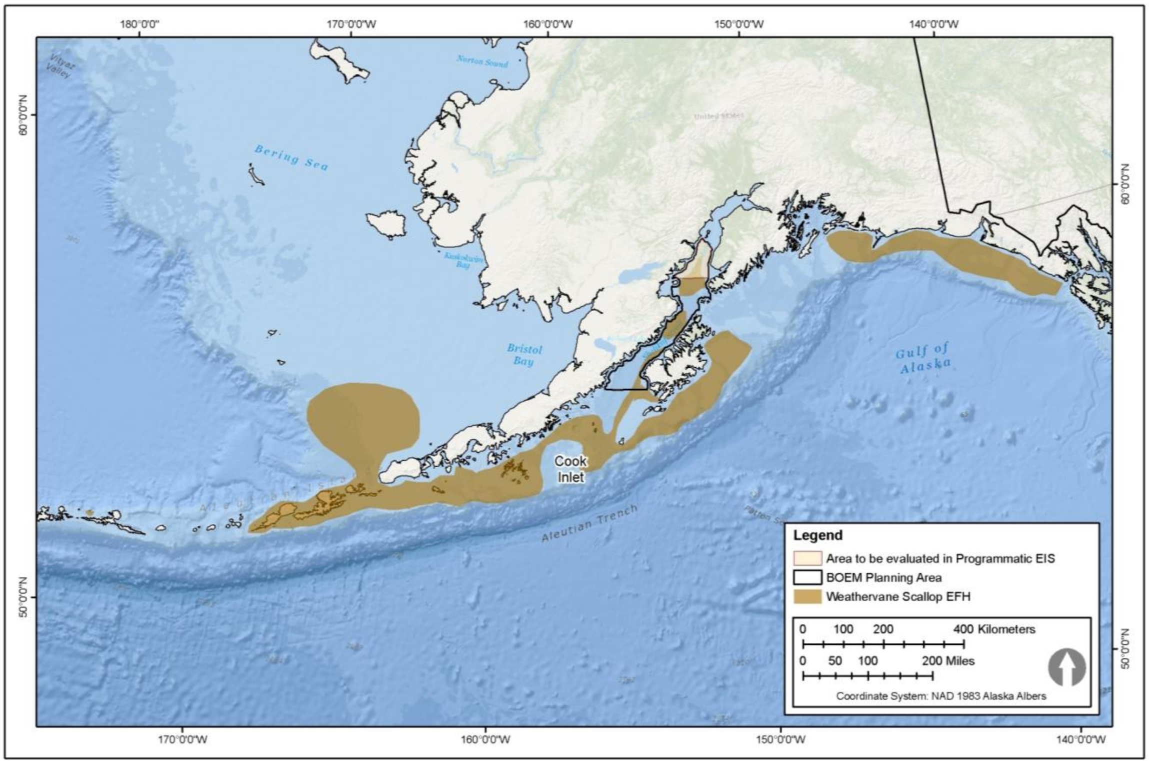


Figure C-70. EFH for the Weathervane Scallop Within the Gulf of Alaska (From: NPFMC, 2014).

These species do have the potential for commercial harvest but since they are smaller than the weathervane scallop, a commercial fisheries has not been developed (NPFMC, 2014). The ADFG closed the upper boundaries of Cook Inlet to scallop fisheries, and the lower limits of Cook Inlet are closed to scallop fishing to reduce crab and groundfish bycatch and to protect crab habitat from scallop dredge and bottom trawl damage (NPFMC, 2014). The habitats in which these scallop species are found range between intertidal waters to a depth of 300 m (984 ft). Highest abundance is between 45 and 130 m (148 and 426 ft) on beds of mud, clay, sand, and gravel (NPFMC, 2014). EFH has been defined for all life history stages from egg to adult. No HAPC has been designated within Cook Inlet for scallops.

Salmon fisheries within the State of Alaska's territorial waters and the federal EEZ are managed at the international, state, and federal level through the Salmon Treaty, an arrangement between the U.S. and Canada to better manage the five commercially viable species that range within the Gulf of Alaska (**Table C-28**). The Salmon Treaty became effective in 1985 and there have been three amendments (1992, 2002, and 2009). Salmon are managed through the Magnuson-Stevens Fishery Conservation and Management Act and through Alaskan state law. The NPFMC collaboratively develops the Salmon FMP (NPFMC, 2012) based on negotiated objectives between the Council, NMFS, and the State of Alaska.

Table C-28. Salmon Species with EFH Described in the Salmon FMP (From: NPFMC, 2012).

Common Name	Scientific Name	Life Stage				
		Egg	Larval	Early Juvenile	Late Juvenile	Adult
Chinook salmon	*Oncorhynchus tshawytscha*	–	–	✓	✓	✓
Coho salmon	*Oncorhynchus kisutch*	–	–	✓	✓	✓
Pink salmon	*Oncorhynchus gorbuscha*	–	–	✓	✓	✓
Sockeye salmon	*Oncorhynchus nerka*	–	–	✓	✓	✓
Chum salmon	*Oncorhynchus keta*	–	–	✓	✓	✓

Figure C-71 depicts the EFH habitat for the five salmon species that inhabit the GOA and the Cook Inlet Program Area. As stipulated in the Salmon FMP through Amendment 12 (77 FR 75570, December 21, 2012), historic net fisheries within Cook Inlet have been closed since 2012. Within the upper boundaries of Cook Inlet, all salmon fishery regulations, and management of commercial, subsistence, and sport fishing is under the jurisdiction of ADFG. No HAPC has been designated within Cook Inlet for salmon.

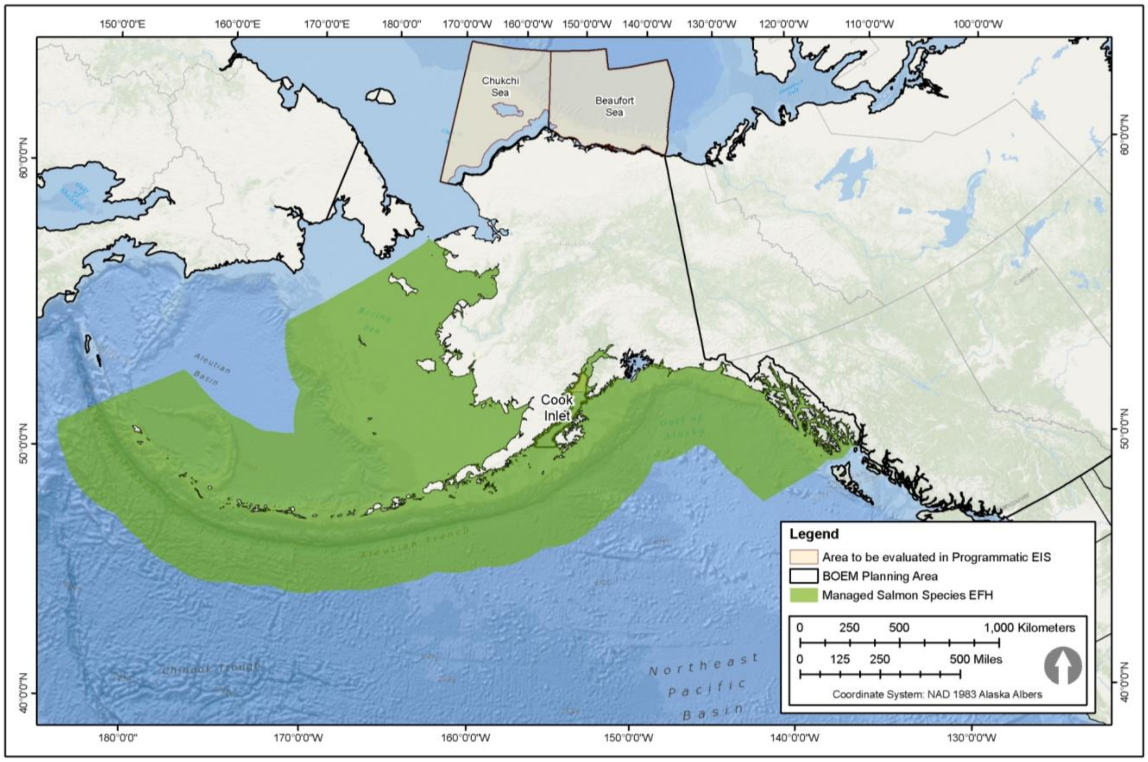


Figure C-71. EFH for the Five Managed Salmon Species in the EEZ off Alaska (Data from: USDOC, NMFS).

8.1.2. Fishes

8.1.2.1. Listed Species

There are no listed species in the Beaufort Sea and Chukchi Sea Program Areas.

8.2. GULF OF MEXICO PROGRAM AREA

8.2.1. Essential Fish Habitat

The Program Area covers a broad geographic and bathymetric region that features a dynamic mix of fishery species. Fishery resources within the Program Area (Figure 2.1-2 in the Programmatic EIS) are primarily managed by the Gulf of Mexico Fishery Management Council (GMFMC) utilizing seven FMPs. The seven FMPs manage 182 fishery species grouped as follows: reef fish (31), coastal migratory pelagic fish (3), red drum (*Sciaenops ocellatus*) (1), shrimp (4), spiny lobster (*Panulirus argus*) (1), and corals (142). EFH for managed fisheries is described in the respective FMPs.

Migratory pelagic fish species currently are managed jointly by the GMFMC and SAFMC. In addition to these FMPs, 39 highly migratory fishery species (tunas [5], billfishes [5], sharks [28], and swordfish [1]) occurring in the Gulf of Mexico are managed by the Highly Migratory Species Management Unit within the Office of Sustainable Fisheries under NMFS.

The aforementioned species all occur in the Gulf of Mexico for at least a portion of their life cycles. The following sections (categorized by generalized habitat [hard bottom, soft bottom, or pelagic]) briefly describe the EFH and HAPCs located within the defined project area for all life stages as outlined by the management entities. HAPCs are defined as discrete sites that meet one or more of the following criteria: "Importance of ecological function provided by the habitat; extent to which the area or habitat is sensitive to human induced degradation; whether and to what extent development activities are stressing the habitat; and rarity of the habitat type" (GMFMC, 2005) (**Figure C-72**).

8.2.1.1. Hard Bottom

Reef Fishes

The reef fish management unit consists of 31 species represented by six families, but is primarily composed of snappers (Lutjanidae) and groupers (Epinephelidae). The remaining families of tilefish (Malacanthidae), jacks (Carangidae), triggerfish (Balistidae), and wrasses (Labridae) contribute only nine species (**Table C-29**). The original FMP for reef fishes was implemented in 1984 (GMFCF, 1981a), and the most recent amendment was implemented in 2008. EFH for the reef fish unit includes hard bottom features found within the Gulf of Mexico including coral reefs, live hard bottom, artificial reefs, and rocky outcroppings. As defined within the FMP, EFH also includes all water from estuarine waters out to depths of 100 fathoms managed by the GMFMC from the Texas-Mexico border east to the waters managed by the SAFMC (GMFMC, 2005) (**Figure C-72**). HAPCs found within the Program Area include 29 Fathom Bank, Alderice Bank, Bouma Bank, East and West Flower Garden Banks, Florida Middle Grounds, Geyer Bank, Jakkula Bank, MacNeil Bank, Madison-Swanson Marine Reserve, McGrail Bank, Pulley Ridge, Rankin Bright Bank, Rezak Sidner Bank, Stetson Bank, Sonnier Bank, and Tortugas North and South. The HAPCs designation for these are based primarily on the presence of living coral reefs or hard bottom containing coral colonies. In addition to coral growth, the Madison-Swanson Marine Reserve is also a known spawning ground for gag grouper (*Mycteroperca microlepis*) and scamp grouper (*M. phenax*).

Table C-29. Hard Bottom Species with EFH Identified within the AOI (Modified From: GMFMC, 2004).

Family	Species	Eggs and Larvae	Juvenile	Adult	Spawning
Triggerfishes (Balistidae)	Gray triggerfish (*Balistes capriscus*)	Pelagic, occur in upper water column, associated with *Sargassum* and flotsam	Associated with *Sargassum*, flotsam, or found in mangrove estuaries	Offshore in water depths >10 m (32.8 ft); associated with natural and artificial reefs	Spawn around natural and artificial reefs in water depths >10 m (32.8 ft); late spring and summer
Jacks (Carangidae)	Greater Amberjack (*Seriola dumerili*)	Pelagic, associated with floating plants and debris	Pelagic, associated with floating plants and debris	Pelagic and epibenthic, occurring over reefs, wrecks, and around buoys; to water depths of 400 m	Little information; spawn in the northern GOM from May to July
	Lesser Amberjack (*Seriola fasciata*)	Pelagic, associated with floating plants and debris	Occur offshore in late summer and fall in northern GOM.; associated with *Sargassum* and flotsam	Offshore year round in northern GOM; associated with oil and gas platforms and irregular bottom features	Spawn offshore September to December and February to March; likely near oil and gas platforms and irregular bottom features
	Almaco jack (*Seriola rivoliana*)	Unknown	Associated with *Sargassum* in open waters and off barrier islands	Offshore, associated with oil and gas platforms in northern GOM	Spawning thought to occur from spring through fall
	Banded rudderfish (*Seriol zonata*)	Pelagic, associated with floating plants and debris	Offshore, associated with jellyfish and floating plants	Pelagic or epibenthic, coastal waters over continental shelf	Spawn offshore in eastern GOM, the Yucatan Channel, and straits of Florida
Wrasses (Labridae)	Hogfish (*Lachnolaimus maximus*)	N/A	Shallow seagrass beds of Florida bay	Moderate-high relief hard bottom structure in shelf waters, coral reefs and rocky flats	N/A
Snappers (Lutjanidae)	Queen snapper (*Etelis oculatus*)	Pelagic, offshore	N/A	Deepwater species in southern GOM; associate with rocky bottoms and ledges between 135 and 450 m (443 and 1,476 ft) water depth	N/A
	Mutton snapper (*Lutjanus analis*)	Shallow continental shelf waters	Shallow seagrass beds in tidal creeks and bights surrounded by mangroves; protected bays	Offshore reef areas, deep barrier reefs	Spawn on steep drop offs near reef areas
	Schoolmaster (*Lutjanus apodus*)	Pelagic	Shallow and offshore habitats, seagrass beds, mangrove habitats, congregate around jetties, inshore and offshore rocky and coral reefs	Coastal waters to 90 m (295 ft) water depth; occur over rock, vegetated sand, inshore and offshore reefs, and mud	Offshore reefs
	Blackfin snapper (*Lutjanus buccanella*)	Present year round in shelf edge waters over spawning areas	Shallow hard bottom areas from 12 to 40 m (39 to 131 ft) water depth	Throughout GOM; shelf edge habitats from 40 to 300 m 131 to 984 ft) water depth	Year round with spring and fall peaks, presumably near shelf edge habitats
	Red snapper (*Lutjanus campechanus*)	Offshore in summer and fall in shelf waters from 17 to 183 m (56 to 600 ft) water depth	Associated with structure, also abundant over sand and mud bottom; from 20 to 46 m (65.6 to 151 ft) water depth	Throughout GOM; occur in submarine gullies and depressions, over coral reefs, rock outcroppings, and gravel bottom; 7 to 146 m (23 to 479 ft) water depth	Offshore from May to October in 18 to 37 m (59 to 121 ft) water depth over fine sand bottom away from reefs
	Cubera snapper (*Lutjanus cyanopterus*)	Presumed in June and July as a result of spawning aggregations, open water near reefs and wrecks	Streams, canals, seagrass beds, mangrove areas, and lagoons	Most common off southwestern Florida; shallow and deep reefs and wrecks; mangroves; up to 85 m (279 ft) water depth	Spawn in June and July near wrecks and deep reefs in 67 to 85 m (220 to 279 ft) water depth

Table C-29. Hard Bottom Species with EFH Identified within the AOI (Modified From: GMFMC, 2004) (Continued).

Family	Species	Eggs and Larvae	Juvenile	Adult	Spawning
	Gray snapper (*Lutjanus griseus*)	Occur June through August in offshore shelf waters and near coral reefs; move to estuarine habitats and seagrass beds	Marine, estuarine, and riverine dwellers, prefer *Thalassia* sp. grass beds, marl bottoms, seagrass meadows, and mangrove roots	Estuaries and shelf waters 180 m (590 ft) water depth; demersal and mid-water dwellers; marine, estuarine, and riverine dwellers	Spawn offshore around reefs and shoals from June to August
Snappers (Lutjanidae) (cont.)	Dog snapper (*Lutjanus jocu*)	Pelagic	Shallow water seagrass beds; coastal waters, estuaries, or rivers; mangrove roots, jetties, and pilings	From shallow vegetated areas to deep reefs to 150 m (492 ft) water depth; coral reefs	Spawning aggregations near reefs from 15 to 30 m (49 to 98 ft) water depth
	Mahogany snapper (*Lutjanus mahogoni*)	Pelagic	N/A	Throughout GOM; shallow water down to 30 m (98 ft)water depth; rocky bottoms and reefs	Multiple spawnings, spring and fall
	Lane snapper (*Lutjanus synagris*)	Offshore, on shelf	Mangrove and grassy estuarine areas; shallow areas with sandy and muddy bottoms; grass flats, reefs, and soft bottom to 20 m (65.6 ft) water depth	Offshore from 4 to 132 m (13 to 433 ft) water depth; occur on sand bottom, natural channels, banks, and artificial reefs and structures	Offshore from March through September
	Silk snapper (*Lutjanus vivanus*)	N/A	Shallow water	Throughout GOM; near the edge of continental and island shelves, common between 90 and 200 m (295 to 656 ft) water depth	Throughout the year with peak spawning from July to August
	Yellowtail snapper (*Ocyurus chrysurus*)		Nearshore areas over vegetated sandy substrate, muddy shallow bays, *Thalassia* sp. beds and mangrove roots, shallow reef areas	Throughout shelf area of GOM, shallow water to 183 m (600 ft) water depth; semi-pelagic wanderers over reef habitat, irregular bottom, coral reefs, banks, and shelves	February through October in offshore areas
	Wenchman (*Pristipomoides aquilonaris*)	Presumed in warmer months along mid- to outer shelf	N/A	Throughout GOM; hard bottom habitats of mid to outer shelf; 19 to 378 m (62 to 1,240 ft) water depth	Presumed warmer months along deep slopes between 80 and 200 m (262 to 656 ft) water depth
	Vermilion snapper (*Rhomboplites aurorubens*)	N/A	Reefs, underwater structures and hard bottom habitats 20 to 200 m water depth	Throughout shelf area of GOM, demersal, over reefs and rocky bottom from 20 to 200 m (65.6 to 656 ft) water depth	April to September in offshore areas
Tilefishes (Malacanthidae)	Goldface tilefish (*Caulolatilus chrysops*)	N/A	N/A	N/A	N/A
	Blackline tilefish (*Caulolatilus cyanops*)	N/A	N/A	N/A	N/A
	Anchor tilefish (*Caulolatilus intermedius*)	N/A	N/A	Common in northern and western GOM; irregular bottom, troughs, terraces, sand, mud and rubble, shell hash	N/A

Table C-29. Hard Bottom Species with EFH Identified within the AOI (Modified From: GMFMC, 2004) (Continued).

Family	Species	Eggs and Larvae	Juvenile	Adult	Spawning
	Blueline tilefish (*Caulolatilus microps*)	Pelagic, offshore	N/A	Eastern and southeastern GOM; epibenthic browsers	N/A
	Golden tilefish (*Lopholatilus chamaeleonticeps*)	Pelagic	Pelagic to benthic; burrow and occupy shafts in the substrate	Throughout GOM; demersal from 80 to 450 m water depth; rough bottom, steep slopes; burrow	From March to November throughout range
Groupers (Epinephelidae)	Rock hind (*Epinephelus adscensionis*)	Pelagic, offshore	Early juveniles in shallow waters	Shallow hard bottom, coral and rock reefs, rock piles, oil and gas platforms, steep crevices and ledges; 2 to 100 m (6.6 to 328 ft) water depth	January to June in Florida middle grounds in spawning aggregations
	Speckled hind (*Epinephelus drummondhayi*)	Pelagic, offshore	Found in shallow end of depth range	Northern and eastern GOM on offshore hard bottom habitats, rocky bottom, high and low profile bottom; 25 to 183 m (82 to 600) water depth	Deeper portion of depth range, >146 m (479 ft) depth along shelf edge, April to May, July to September
	Yellowedge grouper (*Hyporthodus flavolimbatus*)	Pelagic, offshore	Inhabit burrows	Throughout deep waters of GOM; high relief hard bottom, rocky out-croppings, inhabit burrows; 35 to 370 m (115 to 1,214 ft) water depth	Form spawning aggregations, peak May to September
	Red hind (*Epinephelus guttatus*)	Pelagic, settle and develop in shallow inshore areas	Patch reefs, coral and limestone rock	Occupy reefs, stony coral, holes, and crevices, sandy bottoms with coral patches; 18 to 110 m (59 to 361 ft) water depth	Late spring and summer on Florida Middle Grounds along seaward side of submerged ridges
	Goliath grouper (*Epinephelus itajara*)	Offshore, late summer, early fall	Bays and estuaries, inshore grass beds, canals, mangroves, ledges, reefs, and holes	Shallow waters of GOM to 95 m (312 ft) water depth; inshore around docks, bridges, jetties, reef crevices, offshore ledges and wrecks	June to December around offshore structures, wrecks, and patch reefs
	Red grouper (*Epinephelus morio*)	Pelagic as larvae, become benthic by 2 mm standard length	Inshore hard bottom approximately 50 m water depth, crevices, grass bets, rock formations, shallow reefs	Demersal throughout the GOM from 3 to 200 m (908 to 656 ft) water depth; rocky outcrops, wrecks, reefs, ledges, crevices and caverns of rock bottom, live bottom	Spawn on Florida banks during April and May, do not aggregate, near low relief habitats often near solution holes
	Misty grouper (*Hyporthodus mystacinus*)	N/A	Shallower water than adults	Offshore throughout GOM; hard bottom slope and shelf substrates, high relief rocky ledges and pinnacles, 100 to 400 m (328 to 1,312 ft) water depth	April through July

Table C-29. Hard Bottom Species with EFH Identified within the AOI (Modified From: GMFMC, 2004) (Continued).

Family	Species	Eggs and Larvae	Juvenile	Adult	Spawning
	Warsaw grouper (*Hyporthodus nigritus*)	Pelagic, offshore	Shallow nearshore habitats, bays	Throughout GOM; hard bottom, rocky, high profile, steep cliffs, rocky ledges, from 40 to 525 m (131 to 1,722 ft) water depth	Likely late summer
	Snowy grouper (*Epinephelus niveatus*)	Pelagic, offshore	Shallow, nearshore reefs	Deep water, rocky bottom, offshore around boulders and ridges	April to July off of Florida Keys; May to August west Florida
	Nassau grouper (*Epinephelus striatus*)	December to February, nearshore, 0.8 to 16 km from shore	Inshore seagrass beds, macroalgal mats, tilefish mounds, and small coral clumps	Reefs and crevice caves down to 100 m (328 ft) water depth; primarily along the Florida Keys reef tract	Spawning offshore reefs and hard bottom outside of GOM Program Area
	Marbled grouper (*Epinephelus inermis*)	N/A	N/A	Nearshore and offshore reefs, 3 to 213 m (9.8 to 699 ft)	N/A
Groupers (Epinephelidae) (cont.)	Black grouper (*Mycteroperca banaci*)	Pelagic, offshore	Shallow water reefs, rocky bottom, patch reefs, muddy bottom, mangrove lagoons, estuaries	Found along eastern GOM, rare in western GOM, demersal from shore to 150 m water depth; wrecks, rocky coral reefs, irregular bottom, ledges	Late winter through spring and summer, aggregations observed in Florida keys at 18 to 28 m (59 to 92 ft) water depth
	Yellowmouth grouper (*Mycteroperca interstitialis*)	Pelagic, offshore	Mangrove-lined lagoons	Campeche Bank, west coast of Florida, Texas Flower Garden Banks, rocky bottoms, coral reefs	Spring and summer
	Gag grouper (*Mycteroperca microlepis*)	Pelagic, greatest offshore abundance on West Florida Shelf December through April	Move through inlets into coastal lagoons, high salinity estuaries in April and May, become benthic and settle into grass flats and oyster beds; later juveniles move to shallow reef habitats from 1 to 50 m water depth	Demersal; hard bottom substrates, offshore reefs and wrecks, coral and live bottom, depressions and ledges	Aggregate in 50 to 120 m (164 to 394 ft) water depth along shelf edge breaks from December to April on west Florida shelf
	Scamp (*Mycteroperca phenax*)	Pelagic; occur in spring	Inshore hard bottom and reefs, 12 to 33 m water depth	Demersal, throughout shelf areas of GOM, ledges, high relief hard bottom in water depth from 12 to 189 m (39 to 620 ft)	Late February to early June in aggregations, shelf edge, often spawn on *Oculina* formations
	Yellowfin (*Mycteroperca venosa*)	N/A	Shallow seagrass beds, move to deeper rocky bottoms with age	Uncommon in GOM, primarily southern GOM, reef ridge and high relief spur and groove reefs	March to August in eastern GOM

N/A = not available; GOM = Gulf of Mexico.

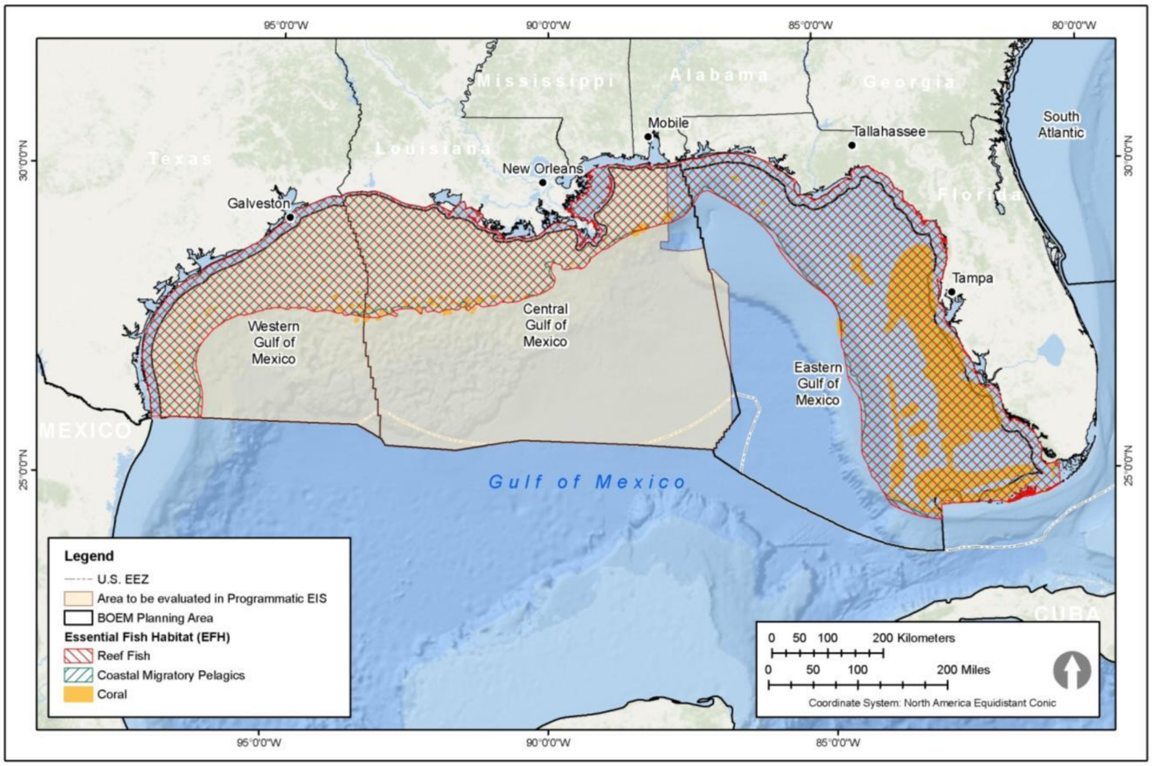


Figure C-72. EFH for Coral, Reef Fish, and Coastal Migratory Pelagics Within the Gulf of Mexico (From: http://sero.nmfs.noaa.gov).

Spiny Lobster

The FMP for spiny lobster in the Gulf of Mexico and off the Atlantic coast was implemented in 1982 (GMFMC, 1982a). The spiny lobster management unit includes only one species of lobster. EFH for the spiny lobster extends from Tarpon Springs, Florida, to Naples, Florida, between water depths of 5 and 10 fathoms; and from Sanibel, Florida, to the boundary between the areas covered by the GMFMC and the SAFMC out to water depths of 15 fathoms (GCFMC, 2005) (**Figure C-73**). This EFH generally consists of coral reefs, areas of hard bottom, and rock outcroppings found over shelf waters along the western Florida coast and Florida Keys. No HAPC for spiny lobster has been established in the Gulf of Mexico Program Area.

Stone Crab

Two species of stone crab (Gulf stone crab [*Menippe adina*] and Florida stone crab [*M. mercenaria*]) were previously managed by the GMFMC under an FMP. Both species are found within the project area and utilize a variety of habitat types throughout their life cycle. Life histories of the two species are similar, generally laying eggs over soft and sand/shell bottom types (Florida stone crab often use hard bottom), while juveniles and adults inhabit hard bottoms, oyster reefs and soft or sand bottoms <62 m (203 ft) deep. The FMP for stone crabs was repealed effective 24 October 2011 and all federal regulations from 50 CFR 654 were removed. The FWC voted in June 2011 to extend its regulatory authority into federal waters, which it is authorized to do in the absence of federal regulations. This effectively eliminated any gap in regulatory authority for the management of stone crabs in federal waters offshore Florida. The FWC has yet to develop an FMP for stone crab. The stone crab fishery in federal waters offshore Florida is subject to the same regulations as required by the State of Florida in state waters.

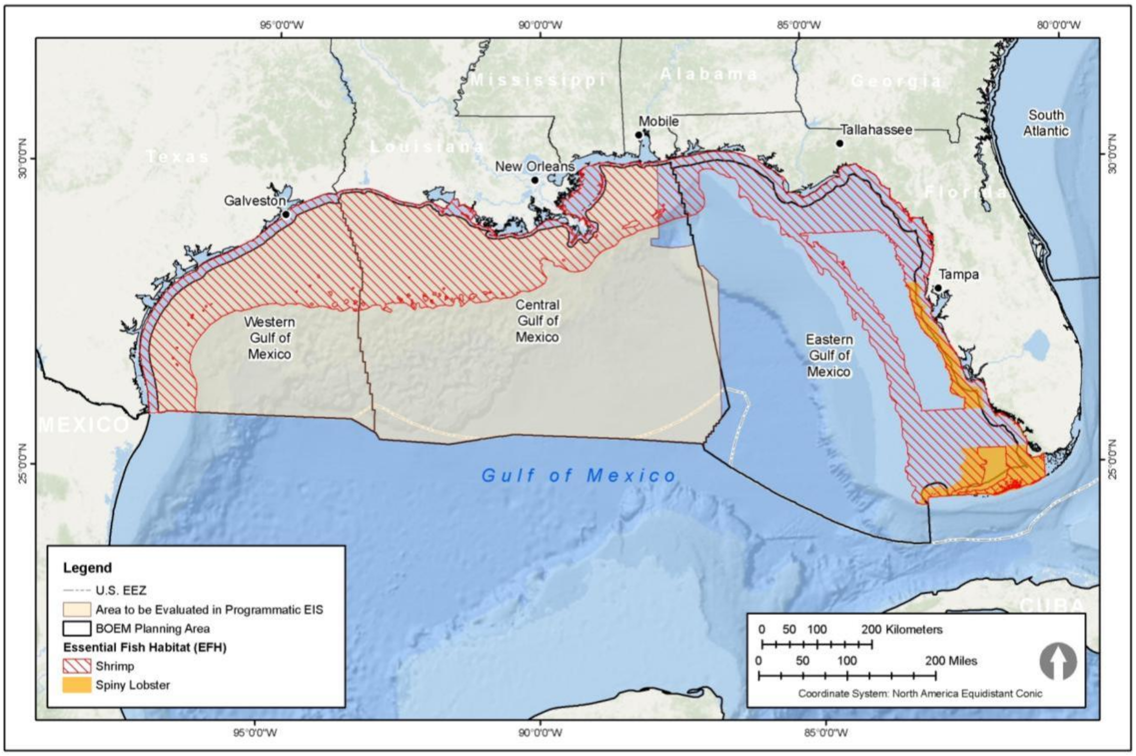


Figure C-73. EFH for Spiny Lobster and Shrimp Within the AOI (From: http://sero.nmfs.noaa.gov).

Coral

The coral management unit encompasses 142 species of stony (Class Anthozoa) and soft coral (Class Hydrozoa). This includes fire or stinging corals (Order Milleporina), stony corals (Order Scleractinia), and black corals (Order Antipatharia). EFH for the coral management unit includes the total distribution of coral species and life stages throughout the Gulf of Mexico including: coral reefs in the North and South Tortugas Ecological Reserves, East and West Flower Garden Banks, McGrail Bank, and the southern portion of Pulley Ridge. Additionally, EFH includes hard bottom areas on the scattered pinnacles and banks from Texas to Mississippi, the shelf edge at the Florida Middle Grounds, the southwest tip of the Florida Reef Tract, and hard bottom offshore of Florida from approximately Crystal River south to the Florida Keys (GCFMC, 2005) (**Figure C-74**).

The original coral FMP (GCFMC, 1982b) established HAPCs in areas where the use of fishing gear deployed from vessels that would have contact with the seafloor was prohibited. These protections are unique relative to other HAPCs that do not prohibit bottom disturbance. The East and West Garden Flower Banks and Stetson Bank are identified by GMFMC as Coral HAPCs. McGrail Bank has also been identified as a unique coral system, granting it protections under the Coral HAPC definition (50 CFR 622.74).

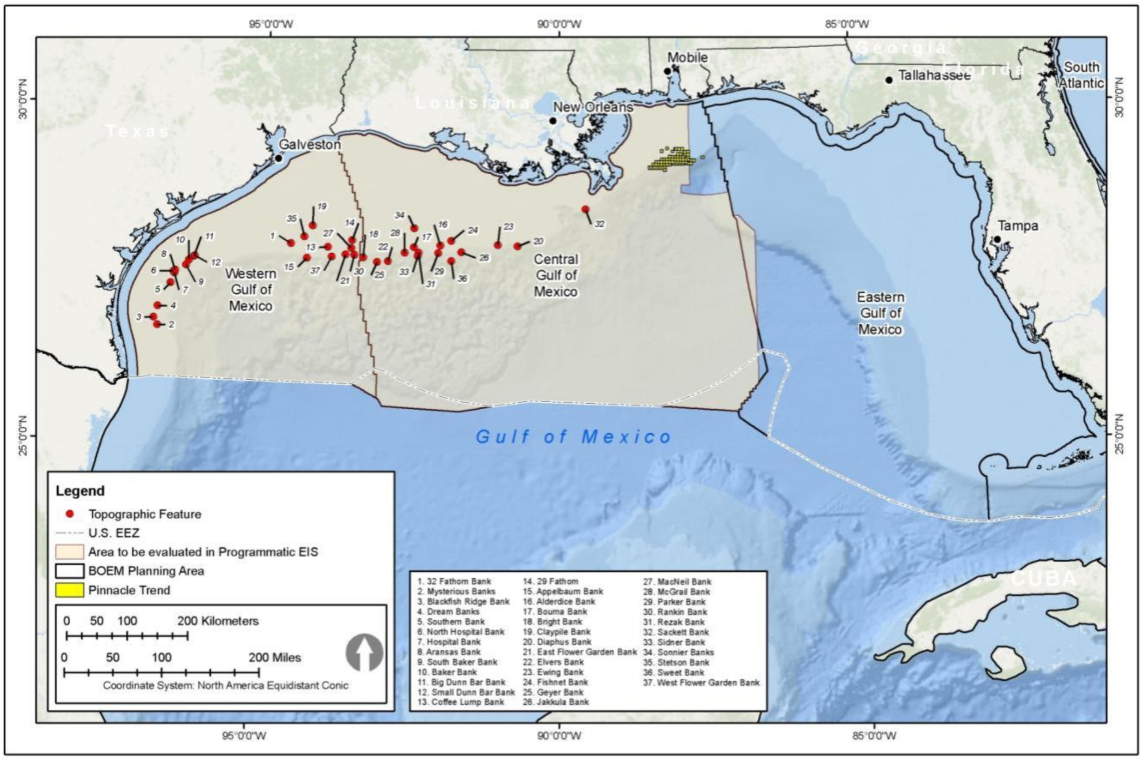


Figure C-74. Topographic Features Located in the Gulf of Mexico Program Area.

8.2.1.2. Soft Bottom

Shrimp

The original FMP for shrimp was implemented in 1981 (GMFMC, 1981b). The shrimp management unit consists of four species of shrimp including brown shrimp (*Farfantepenaeus aztecus*), white shrimp (*Litopenaeus setiferus*), pink shrimp (*F. duorarum*), and royal red shrimp (*Pleoticus robustus*). EFH for shrimp FMP found within the Program Area extends from the U.S.-Mexico border to Fort Walton Beach, Florida, from estuarine waters out to a water depth of 100 fathoms; from Grand Isle, Louisiana, to Pensacola Bay, Florida, from water depths of 100 to 325 fathoms; from Pensacola Bay, Florida, to the boundary between the areas covered by the GMFMC and the SAFMC to a water depth of 34 fathoms, with the exception of waters extending from Crystal River to Naples, Florida, between water depths of 10 and 25 fathoms, and in Florida Bay between water depths of 5 and 10 fathoms (GMFMC, 2005) (**Figure 8.1-2**). There are no HAPCs defined for shrimp species in the Gulf of Mexico Program Area.

8.2.1.3. Pelagic Species

Red Drum

The original FMP for red drum was implemented in 1987 (GMFMC, 1986). The red drum management unit contains only one species. The red drum is a member of the drum and croaker family Sciaenidae that ranges from inshore, estuarine habitats to nearshore and offshore areas. EFH for red drum includes nearshore waters from Vermilion Bay, Louisiana to the eastern edge of Mobile Bay, Alabama out to 25 fathoms water depth; Crystal River to Naples, Florida between water depths of 5 and 10 fathoms; and Cape Sable, Florida to the boundary managed by the SAFMC between water depths of 5 and 10 fathoms (GMFMC, 2005) (**Figure C-75**). There is no HAPC defined for red drum in the Gulf of Mexico Program Area.

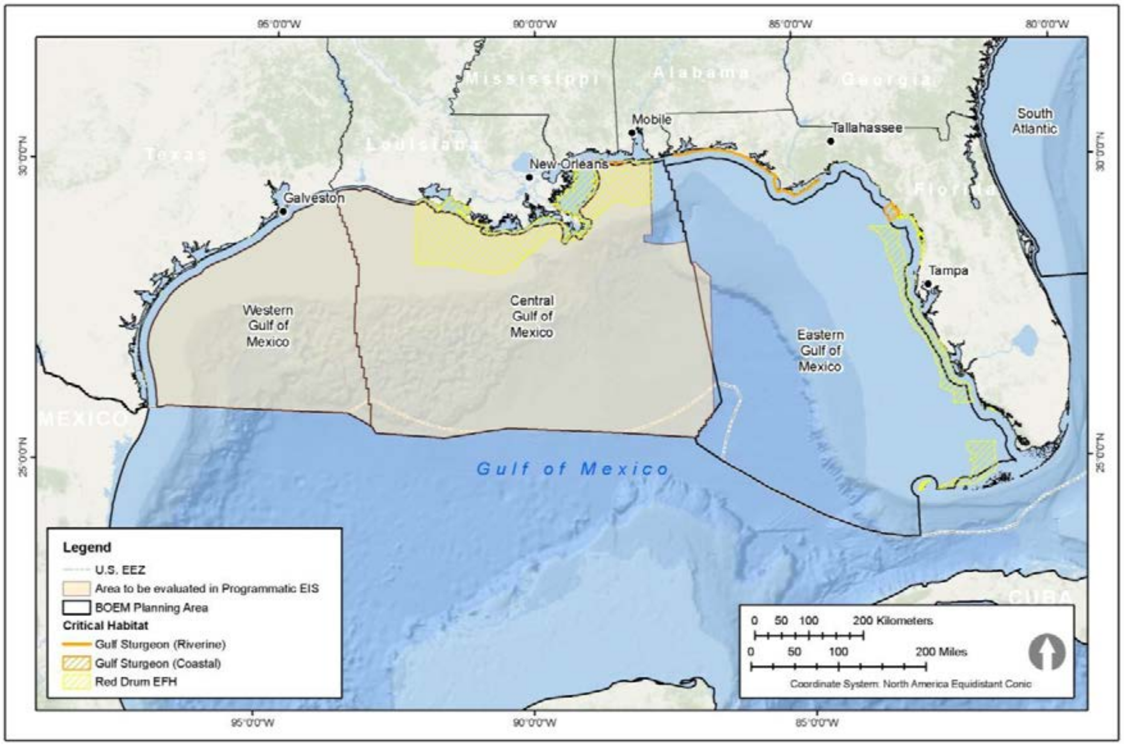


Figure C-75. EFH for Red Drum and Critical Habitat for Gulf Sturgeon Within the Gulf of Mexico (From: http://sero.nmfs.noaa.gov).

8.2.1.4. Coastal Pelagic

The coastal migratory pelagic fish unit, as defined by the GMFMC (1983) and SAFAC, includes three species representing two families: king mackerel (*Scomberomorus cavalla*) and Spanish mackerel (*Scomberomorus maculatus*) in the Family Scombridae, and cobia in the Family Rachycentridae (**Table C-30**). EFH for the coastal migratory pelagic fish is identical to that of the reef fish unit encompassing all waters from the U.S./Mexico border east to SAFMC managed waters, and from estuarine waters out to water depth of 100 fathoms (GMFMC, 2005). There are no HAPCs defined for any of the coastal migratory pelagic fish in the Gulf of Mexico Program Area.

Table C-30. Coastal Migratory Pelagic Species and Life Stages with EFH Identified within the AOI (Modified From: GMFMC, 2004).

Species	Eggs and Larvae	Juvenile	Adult	Spawning
King mackerel (*Scomberomorus cavalla*)	Pelagic eggs offshore over areas of 35 to 180 m (115 to 590 ft) water depth, middle and outer continental shelf	Inshore to the middle shelf	Throughout GOM, over reefs and coastal waters, generally in <80 m (262 ft) water depth	Over the outer continental shelf from May to October
Spanish mackerel (*Scomberomorus maculatus*)	Pelagic eggs over inner continental shelf at water depths <50 m (164 ft) in spring and summer	Estuarine and coastal waters	Throughout GOM, inshore coastal waters, may enter estuaries, to water depths of 75 m (246 ft)	Over inner continental shelf from May to September
Cobia (*Rachycentron canadum*)	Eggs drift in the top meter of water column, larvae found in offshore waters	Coastal and offshore waters	Coastal and offshore waters from bays and inlets to the continental shelf; 1 to 70 m water depth (3.3 to 230 ft)	In coastal waters from April through September

GOM = Gulf of Mexico.

8.2.1.5. Highly Migratory

There are 39 highly migratory species currently managed in the Gulf of Mexico by the Highly Migratory Species Management Unit within the Office of Sustainable Fisheries under NMFS, with all of these species spending all or a portion of their life cycle within the Gulf of Mexico Program Area. All five species of billfish (Istiophoridae): blue marlin (*Makaira nigricans*), longbill spearfish (*Tetrapturus pfluegeri*), roundscale spearfish (*Tetrapturus georgii*), sailfish (*Istiophorus platypterus*), and white marlin (*Kajikia albida*) have designated EFHs located within the Gulf of Mexico Program Area (**Table C-31**). While no EFH is designated for the spawning, egg, or larval life stage of these species, EFH is defined for juvenile and adult stages and is found throughout the central Gulf of Mexico from the Texas/Mexico border to the Florida Keys. EFH for all life stages of swordfish (Xiphiidae) is located throughout the Program Area from the 200-m (656 ft) depth contour to the EEZ boundary and associated with the Loop Current in the Gulf of Mexico. Five species of tuna (Scombridae): skipjack tuna (*Katsuwonas pelamis*), blackfin tuna (*Thunnus atlanticus*), bluefin tuna (*Thunnus thynnus*), yellowfin tuna (*Thunnus albacores*), and bigeye tuna (*Thunnus obesus*) spend all or some of their life cycle in the Gulf of Mexico with three species (skipjack, bluefin and yellowfin) known to spawn within the Program Area. These tuna species inhabit oceanic waters with EFH for all life stages generally limited to the northern and central Gulf of Mexico, offshore of the continental shelf break. In 2009, NMFS established a HAPC for bluefin tuna in the Gulf of Mexico (USDOC, NMFS, 2009). The bluefin tuna HAPC is located west of 86° W and seaward of the 100-m depth contour, extending to the boundary of the U.S. EEZ. This HAPC includes most of the areas where larval collections have been documented and overlaps with juvenile and adult bluefin tuna EFH (Atlantic Bluefin Tuna Status Review Team, 2011).

Although not directly managed under the GMFMC, dolphinfish and wahoo are also considered highly migratory pelagic fishes and are found throughout the Program Area. Twenty-eight shark species are included within the highly migratory species management unit (**Table C-32**). Shark species are divided into three categories based on their distribution and life history: small coastal sharks (5 species), large coastal sharks (16 species), and pelagic sharks (7 species). Small and large coastal shark species commonly occur over continental shelf waters while pelagic sharks spend a greater portion of their life cycle within deep, oceanic waters. All federally managed shark species have EFH located within the Program Area ranging from all coastal Gulf of Mexico waters to select offshore areas where the species are thought to regularly feed, congregate, or reproduce.

Table C-31. Highly Migratory Species and Life Stages with EFH Identified Within the Program Area.

Species	Eggs and Larvae	Juvenile	Adult	Spawning/Reproduction
Albacore tuna (*Thunnus alalunga*)	N/A	N/A	Epipelagic, oceanic, generally found in surface waters, often associated with *Sargassum* communities and debris	N/A
Bigeye tuna (*Thunnus obesus*)	N/A	School near sea surface with other tuna species, associated with *Sargassum* communities and floating debris	N/A	N/A
Bluefin tuna (*Thunnus thynnus*)	Over continental shelf	Over continental shelf during summer, further offshore in winter	Epipelagic, oceanic, generally found in surface waters, often associated with *Sargassum* communities and debris	Annual spawn May to June in GOM
Skipjack tuna (*Katsuwonus pelamis*)	N/A	N/A	Epipelagic, oceanic, as deep as 260 m (656 ft) during the day, associate with drifting objects, whales, sharks, and other tuna species	Opportunistic spawning throughout year, most spawning from April to May
Yellowfin tuna (*Thunnus albacares*)	Limited to water temperature >24°C (75º F)and salinity >33 (91.4º F)	Nearer to shore than adults	Epipelagic, oceanic, mix with skipjack and bigeye tuna species, occur beyond 500 fathom depth contour in the upper 100 m (328 ft) of water column	Spawning throughout year with peaks in the summer
Swordfish (*Xiphias gladius*)	Present year round in eastern GOM, also present in western GOM from March to May and September to November	N/A	Epipelagic to mesopelagic, diurnal vertical migration	N/A
Blue marlin (*Mokaira nigricans*)	Some larvae present in GOM	N/A	Epipelagic and oceanic	N/A
White marlin (*Tetrapturus albidus*)	N/A	Off west coast of Florida between the 200- and 2,000-m (656- to 6,562-ft) depth contours; off coast of Texas to 50-m (164-ft) depth contour	Epipelagic and oceanic, usually occur above thermocline in deep ≥100 m (328 ft) water with surface temperature ≥22°C (71.6º F) and salinities of 35 to 37; usually in upper 30 m (98 ft) of water column	N/A
Roundscale spearfish (*Tetrapturus georgii*)	N/A	N/A	Epipelagic and oceanic	N/A
Sailfish (*Istiophorus platypterus*)	Larvae found in offshore waters from March to October	In all waters of the GOM from 200 to 2,000-m depth contour or EEZ boundary	Epipelagic, coastal, and oceanic; usually found above thermocline at a temperature range of 21°C to 28°C (69.8 to 82.4º F); often move to inshore waters and over shelf edge	Occurs in shallow waters around Florida beyond 100-m (328-ft) depth contour, from April to September.

Table C-31. Highly Migratory Species and Life Stages with EFH Identified Within the Program Area (Continued).

Species	Eggs and Larvae	Juvenile	Adult	Spawning/Reproduction
Longbill spearfish (*Tetrapturus pfluegeri*)	N/A	N/A	Relatively rare in GOM; epipelagic, oceanic species inhabiting waters above the thermocline; generally found in offshore waters	N/A
Dolphin* (*Coryphaena hippurus*)	Larvae abundant in *Sargassum* communities, prominent near Mississippi River delta	Closely associated with *Sargassum* communities and floating debris	Oceanic pelagic; both offshore and coastal inshore; out to 1,800 m (5,905 ft) water depth, common between 40 to 200 m (131 to 656 ft) water depth, closely associated with *Sargassum* communities	Multiple spawning events throughout year; spring and early fall in GOM; offshore, continental shelf and upper slope waters
Wahoo* (*Acanthocybium solandri*)	Oceanic and shelf waters	Oceanic and shelf waters, associated with *Sargassum* communities and flotsam	Oceanic and shelf waters, associated with *Sargassum* communities and flotsam	N/A

N/A = not available; GOM = Gulf of Mexico.
* Species not managed in the Gulf of Mexico by NMFS.

Table C-32. Coastal Shark Species and Life Stages with EFH Identified Within the AOI (Modified From: GMFMC, 2004).

Shark Group	Species	Neonates/Juvenile	Adult	Reproduction
Small Coastal	Angel shark (*Squatina dumeril*)	Shallow coastal waters	Shallow coastal waters	Up to 16 pup litters
	Bonnethead shark (*Sphyrna tiburo*)	N/A	Shallow coastal waters, sandy and muddy bottoms	Annual reproductive cycle, 8 to 12 pup litters
	Atlantic sharpnose shark (*Rhizoprionodon terraenovae*)	Shallow coastal waters	Shallow coastal waters	Late June, 4 to 7 pup litters
	Blacknose shark (*Carcharhinus acronotus*)	Shallow coastal waters	Shallow coastal waters	3 to 6 pup litters
	Finetooth shark (*Carcharhinus isodon*)	Shallow coastal waters, muddy bottom	Shallow coastal waters	Biennial reproductive cycle, 2 to 6 pup litters
Large Coastal	Great hammerhead shark (*Sphyrna mokarran*)	Shallow coastal waters	Open ocean and shallow coastal waters	Biennial reproductive cycle, 20 to 40 pup litters
	Scalloped hammerhead shark (*Sphyrna lewini*)	Shallow coastal waters	Schooling, open ocean and shallow coastal waters	Annual reproductive cycle, 15 to 31 pup litters
	White shark (*Carcharodon carcharias*)	N/A	N/A	N/A
	Nurse shark (*Ginglymostoma cirratum*)	Shallow *Thalassia* beds and shallow coral reefs, mangrove islands	Littoral waters, congregates in shallow water	June to July in the shallow waters of the Florida Keys, 20 to 30 pup litters

Table C-32. Coastal Shark Species and Life Stages with EFH Identified Within the AOI (Modified From: GMFMC, 2004) (Continued).

Shark Group	Species	Neonates/Juvenile	Adult	Reproduction
	Bignose shark (*Carcharhinus altimus*)	N/A	Deep water species, continental shelf	N/A
Large Coastal (cont.)	Blacktip shark (*Carcharhinus limbatus*)	Year round in shallow coastal waters, seagrass beds and muddy bottoms	Shallow coastal waters and offshore surface waters of continental shelf, throughout GOM	1 to 8 pup litters
	Bull shark (*Carcharhinus leucas*)	Low salinity estuaries of the GOM coast	Shallow coastal waters and often fresh water	Likely biennial reproductive cycle
	Caribbean reef shark (*Carcharhinus perezi*)	N/A	Shallow coastal waters, bottom-dwelling, near coral reefs	Biennial reproductive cycle, 4 to 6 pup litters
	Dusky shark (*Carcharhinus obscurus*)	Shallow coastal waters, inlets, and estuaries	Migratory, inshore and outer continental shelf waters	6 to 14 pup litters
	Lemon shark (*Negaprion brevirostris*)	Shallow coastal water, near mangrove islands	Shallow coastal waters, around coral reefs	Biennial reproductive cycle, 5 to 17 pup litters
	Night shark (*Carcharhinus signatus*)	N/A	Depths 275 to 366 m (902 to 1,201 ft) during the day and 183 m (600 ft) at night	N/A
	Sandbar shark (*Carcharhinus plumbeus*)	Shallow coastal waters	Shallow coastal waters	Biennial reproductive cycle, March to July, 1 to 14 pup litters
	Silky shark (*Carcharhinus falciformis*)	Offshore and shallow coastal waters	Offshore, epipelagic	10 to 14 pup litters
	Spinner shark (*Carcharhinus brevipinna*)	Shallow coastal waters, muddy bottom <5 m water depth, seagrass beds	Migratory, coastal-pelagic	Biennial reproductive cycle, 6 to 2 pup litters
	Tiger shark (*Galeocerdo cuvier*)	N/A	Shallow coastal waters and deep oceanic waters	35 to 55 pup litters
	Whale shark (*Rhincodon typus*)	N/A	Pelagic waters	N/A
Pelagic	Longfin mako shark (*Isurus paucus*)	N/A	Deep water species	2 to 8 pup litters
	Porbeagle shark (*Lamna nasus*)	N/A	Deep water species	N/A
	Shortfin mako shark (*Isurus oxyrinchus*)	N/A	Oceanic waters	Biennial reproductive cycle, 12 to 20 pup litters
	Oceanic whitetip shark (*Carcharhinus longimanus*)	Likely offshore over continental shelf	Oceanic waters	Likely biennial, 2 to 10 pup litters
	Bigeye thresher shark (*Alopias superciliosus*)	N/A	Deep water	2 pup litters
	Common thresher shark (*Alopias vulpinus*)	N/A	Coastal and oceanic waters	Birth annually from March to June, 4 to 6 pup litters
	Smooth dogfish (*Mustelus canis*)	N/A	Continental and insular shelves from shallow inshore waters to a maximum water depth of 579 m (1,900 ft)	4-to 20 pup litters

N/A = not available; GOM = Gulf of Mexico.

8.2.2. Managed Fishes

8.2.2.1. Listed Species

The proposed Gulf of Mexico Program Area includes critical habitat for three endangered fish species which are managed by NMFS and the USFWS as part of the ESA. The smalltooth sawfish (*Pristis pectinata*) and largetooth sawfish (*Pristis perotteti* [formerly *P. pristis*]) of the Family Pristidae are members of the cartilaginous fishes (Class Chondrichthyes). The largetooth sawfish historically was documented in the AOI, however the population has been extirpated from the Gulf of Mexico and no critical habitat is designated for the largetooth sawfish. The Gulf sturgeon (*Acipenser oxyrinchus desotoi*) is a member of Family Acipenseridae of the ray-finned fishes (Class Actinopterygii).

Smalltooth Sawfish (*Pristis pectinata*)

Distribution and Abundance

The historic range of smalltooth sawfish extended throughout the Gulf of Mexico and north to Long Island Sound on the Atlantic Coast but has contracted considerably in U.S. coastal waters over the past 200 years. Currently, the core of the smalltooth sawfish DPS is surviving and reproducing in the waters of southwest Florida and Florida Bay, primarily within the jurisdictional boundaries of Everglades National Park where important habitat features are still present and less fragmented than in other parts of the historic range (Simpfendorfer and Wiley, 2005; USDOC, NMFS, 2009). This area includes most of the critical habitat shown in **Figure C-76**. Since this species is found outside of the Gulf of Mexico Program Area, it is not expected to occur where it could be affected by normal OCS-related oil and gas operations, however, in the event of an oil spill, this species has the potential to be affected. The smalltooth sawfish normally inhabits shallow waters (<10 m [33 ft]), often near river mouths or in estuarine lagoons over sandy or muddy substrates, but also may occur in deeper waters (<50 m [164 ft]) of the continental shelf. Young sawfish generally prefer shallow water where the substrate is muddy and the shore is lined with mangrove trees (USDOC, NMFS, 2009).

Behavior

Smalltooth sawfish grow slowly and mature at approximately 10 years of age. Females bear live young, and litters reportedly range from 1 to 20 embryos (USDOC, NMFS, 2009). Smalltooth sawfish feed on fishes and benthic invertebrates. The saw has been considered as a trophic apparatus, used to herd and even impale shallow-water schooling fishes such as herrings and mullets (Breder, 1952). It appears more likely that the saw is used to rake the seafloor to uncover partially buried invertebrates. Small juvenile sawfishes may be susceptible to predation from bull sharks (*Carcharhinus leucas*) and lemon sharks (*Negaprion brevirostris*) that inhabit similar water depths as the smalltooth sawfish.

Status

In response to a petition from the Ocean Conservancy, NMFS conducted a status review of the smalltooth sawfish in 2000 (USDOC, NMFS, 2000). The status review determined that smalltooth sawfish in U.S. waters includes a DPS that is in danger of extinction throughout its range. On April 1, 2003, NMFS published a final rule (68 FR 15674) listing the U.S. DPS as endangered under the ESA.

Over the past 200 years, smalltooth sawfish populations have declined considerably, primarily because of incidental capture by fishing gear as well as destruction of habitat. The ESA listing was based on the following considerations: the threatened destruction, modification, or curtailment of habitat or range; overutilization for commercial, recreational, scientific, or educational purposes; inadequacy of existing regulatory mechanisms; and other natural and manmade factors affecting the continued existence of the species. Critical habitat for the smalltooth sawfish includes two units on the southwest coast of Florida, in the eastern portion of the Program Area (**Figure C-76)**. The northern unit is the Charlotte Harbor Estuary Unit and the southern unit is the Ten Thousand Islands/Everglades Unit (50 CFR 226.218). Recent studies indicate that key habitat features (particularly for immature individuals) consist of shallow water, especially near mangroves, with estuarine conditions (Simpfendorfer and Wiley, 2005; Simpfendorfer, 2006; USDOC, NMFS, 2009a).

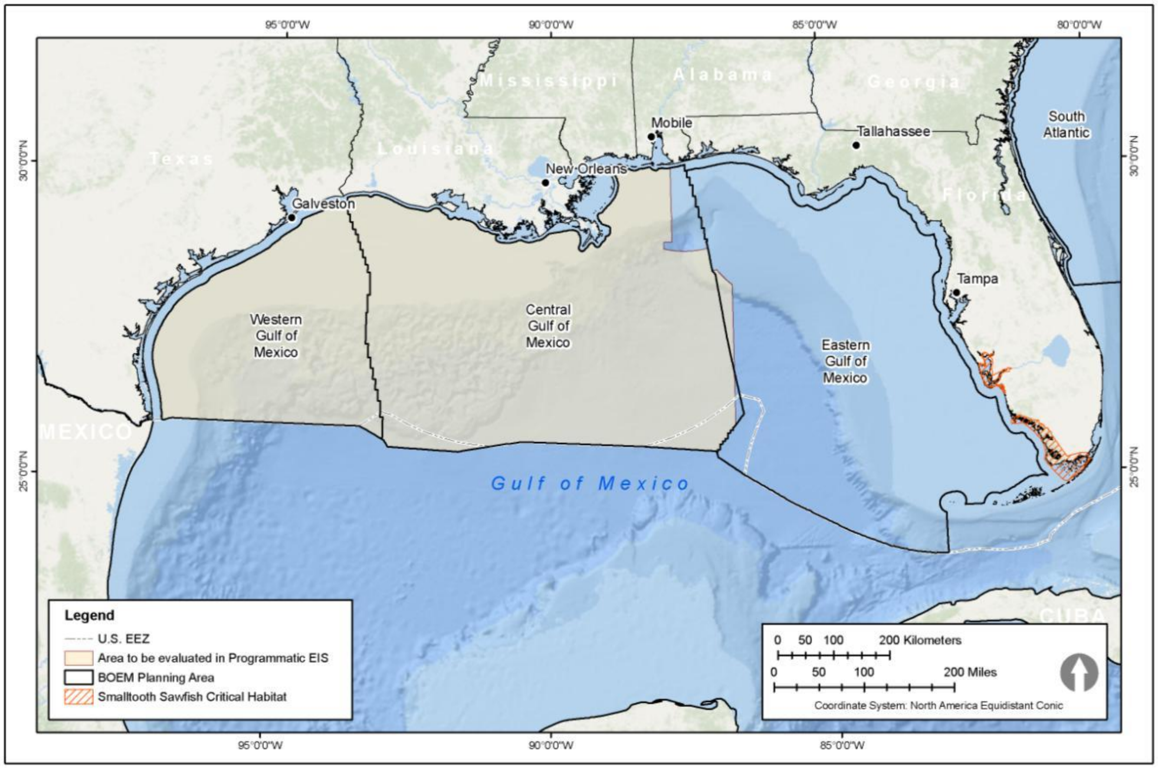


Figure C-76. Critical Habitat for Smalltooth Sawfish in the Gulf of Mexico.

Largetooth sawfish (*Pristis pristis*)

Distribution and Abundance

The historic range of largetooth sawfish is throughout the Gulf of Mexico but mainly within the coastal waters of Texas (79 FR 73985). Of the 39 specimens collected between 1910 and 1961, 33 were recovered off Texas. The largetooth sawfish normally inhabits shallow waters (<10 m [33 ft]), often near river mouths or in estuarine lagoons. Juveniles are found to utilize estuarine and freshwater habitats (salinities of 0), but adults generally are found in waters with an average salinity of 31 parts per thousand (ppt) (79 FR 73985). Adult largetooth sawfish have been found in Lake Nicaragua at a depth of 400 ft (122 m), and in the Amazon River 1,340 km (833 mi) from the coast (USDOC, NMFS, 2010a). Young largetooth sawfish generally prefer shallow water; it is thought that they use this habitat as refuge (79 FR 73985). The largetooth sawfish is normally found outside of U.S. waters and the Gulf of Mexico Program Area, and it is not expected to occur where it could be affected by normal OCS-related oil and gas operations. However, it is possible that in the event of a CDE, the habitats in the Western Planning Area and along the Mexican coast of the Gulf of Mexico could be affected.

Behavior

Largetooth sawfish have been observed to be approximately 2.5 to 3 ft (76 to 91 cm) long at birth. They grow slowly, generally reaching maturity between 8 and 10 years of age, attaining a length of 2.7 to 3 m (9 to 10 ft). Females bear live young, and litters reportedly range from 1 to 13 embryos with the average number of pups being 7 (79 FR 73985). Largetooth sawfish have the same trophic feeding strategy as smalltooth sawfish, focusing onfishes and benthic invertebrates. The largetooth sawfish predominantly subsists on the most abundant small schooling species in its habitat (79 FR 73986). Juvenile largetooth sawfishes may be susceptible to predation from bull sharks and lemon sharks that inhabit similar water depths.

Status

The largetooth sawfish has not been reported in U.S. waters for more than 50 yr but its critical habitat is most likely focused in Texas coastal waters in the Western Planning Area and those of the Gulf of Mexico's Mexican coast (79 FR 73988). The largetooth sawfish is rarely reported in U.S. waters. Where sighted, individuals are thought to have been long-distance migrants from Brazilian waters or the Caribbean basin (79 FR 73988).

Gulf Sturgeon (Acipenser oxyrinchus desotoi)

Distribution and Abundance

The Gulf sturgeon is a geographical subspecies of the Atlantic sturgeon (*Acipenser oxyrinchus oxyrhynchus*). Gulf sturgeon occur in most major tributaries of the northeastern Gulf of Mexico from Lake Ponchartrain and the Mississippi River, east to Florida's Suwannee River, and in the central and eastern Gulf of Mexico as far south as Charlotte Harbor, Florida (Wooley and Crateau, 1985). Gulf sturgeons are currently found in the Pearl, Pascagoula, Escambia, Yellow, Blackwater, Choctawhatchee, Apalachicola, Ochlockonee, and Suwannee Rivers (Reynolds, 1993) (**Figure C-75**).

Five genetically based stocks have been identified by the USFWS and NMFS: (1) Lake Pontchartrain and Pearl River; (2) Pascagoula River; (3) Escambia and Yellow Rivers; (4) Choctawhatchee River; and (5) Apalachicola, Ochlockonee, and Suwannee Rivers. Mitochondrial DNA analyses of individuals from subpopulations indicate that adults return to natal river areas for feeding and spawning (Stabile et al., 1996; Sulak and Clugston, 1999; USDOI, USFWS and USDOC, NMFS, 2009b).

Behavior

Gulf sturgeon are anadromous, meaning adults spend most of their lives in estuarine and marine waters and migrate into freshwater rivers and streams to spawn during the spring and early summer. As a result, critical habitat for this species includes nearshore bays and estuaries from Louisiana to Florida including the following systems: Apalachicola, Choctawhatchee, Escambia, Suwannee, Pascagoula, Pearl, and Yellow Rivers) (50 CFR 226.214). Sounds are produced by free-jumping adult fish during summer months, but the adaptive significance of these sounds is generally unknown (Sulak et al., 2002).

Gulf sturgeon stop feeding while migrating upstream to spawn. Individuals only feed while in the Gulf of Mexico during winter. Sturgeons are bottom suction feeders that have ventrally located, highly extrudable mouths. Gulf sturgeon primarily feed on benthic invertebrates. The sturgeon head is dorsoventrally compressed (flattened) with eyes dorsal, so they detect benthic prey using sensitive barbels, like catfish. The barbels are also useful for navigation in high-order streams if visibility is low and at night.

Status

The USFWS and NMFS listed the Gulf sturgeon a threatened species on September 30, 1991. A recovery plan was developed to ensure the preservation and protection of Gulf sturgeon spawning habitat (USDOI, USFWS and GSMFC, 1995). Critical habitat was designated on March 19, 2003 (68 FR 13370) (**Figure C-75**).

8.3. ATLANTIC PROGRAM AREA

8.3.1. Essential Fish Habitat

The Atlantic Program Area (Figure 2.1-3 in the Programmatic EIS) covers a broad geographic and bathymetric region that features a dynamic mix of fishery species managed by four different federal entities. The two primary FMCs responsible for fisheries and habitats in federal waters of the Atlantic Program Area are the Mid-Atlantic Fisheries Management Council (MAFMC) and SAFMC. These two councils manage these in the Mid-Atlantic Bight (MAB) and South Atlantic Bight (SAB) regions, respectively. Because of regular seasonal movement of additional species into the Atlantic Program Area from New England waters, species under the jurisdiction of another management council, the New England Fishery Management Council (NEFMC), were included in this review. Each of these FMCs has developed EFH descriptions in either separate documents or as amendments to existing FMPs (MAFMC, 1998a,b,c; NEFMC, 1998a,b; SAFMC, 1998; MAFMC and NEFMC, 1999). In addition to the FMPs prepared by these councils, highly migratory species (i.e., tunas, billfishes, sharks, and swordfish) prevalent in the Atlantic Program Area are managed by the Highly Migratory Species Management Unit within the Office of Sustainable Fisheries under NMFS. This group prepared an FMP for highly migratory species that was updated in 2009 and includes descriptions of EFH for sharks, swordfish, and tunas (USDOC, NMFS, 2009a).

Within the EFH designated for various species, particular areas termed HAPCs also are identified. HAPCs either play important roles in the life history (e.g., spawning) of federally managed fish species or are especially vulnerable to degradation from fishing or other human activities.

Species or species groups managed by the SAFMC, MAFMC, NEFMC, and NMFS found within the Atlantic Program Area are listed in **Table C-33**. Species listed in the table were selected based on examination of the FMPs and with the assistance of NOAA's EFH mapper (USDOC, NOAA, 2015). Information describing the biology, ecology, and behavior of fish species that inhabit the MAB and SAB can be found in previous sections of this document.

Table C-33. Plant, Invertebrate, and Fish Species and Species Groups Broadly Associated with Demersal and Pelagic Habitats in the AOI Managed by the SAFMC, MAFMC, NEFMC, and/or Highly Migratory Species Office of NMFS.

Species or Species Groups	SAFMC	MAFMC	NEFMC	NMFS
Demersal				
Coral, coral reefs, and live/hard bottom	■	--	--	--
Spiny lobster (*Panulirus argus*)	■	--	--	--
Snapper-grouper complex (73 species)	■	--	--	--
Tilefish (*Lopholatilus chamaeleonticeps*)	■	■	--	--
Black sea bass (*Centropristis striata*)	■	■	--	--
Scup (*Stenotomus chrysops*)	■	■	--	--
Surfclam (*Spisula solidissima*)	--	■	--	--
Ocean quahog (*Arctica islandica*)	--	■	--	--
Sea scallop (*Placopecten magellanicus*)	--	--	■	--
Calico scallop (*Argopecten gibbus*)	--	--	--	--

Table C-33. Plant, Invertebrate, and Fish Species and Species Groups Broadly Associated with Demersal and Pelagic Habitats in the AOI Managed by the SAFMC, MAFMC, NEFMC, and/or Highly Migratory Species Office of NMFS (Continued).

Species or Species Groups	SAFMC	MAFMC	NEFMC	NMFS
Golden crab (*Chaceon fenneri*)	■	--	--	--
Red crab (*Chaceon quinquedens*)	--	--	■	--
Shrimps (Penaeidae and Sicyonidae)	■	--	--	--
Monkfish (*Lophius americanus*)	--	■	--	--
Spiny dogfish (*Squalus acanthias*)	--	■	■	--
Offshore hake (*Merluccius albidus*)	--	■	■	--
Silver hake (*Merluccius bilinearis*)	--	--	■	--
Red hake (*Urophycis chuss*)	--	--	■	--
Witch flounder (*Glyptocephalus cynoglossus*)	--	--	■	--
Summer flounder (*Paralichthys dentatus*)	--	--	■	--
Windowpane flounder (*Scophthalmus aquosus*)	--	--	■	--
Pelagic				
Sargassum	■	--	--	--
Long-finned squid (*Loligo pealei*)	--	■	--	--
Short-finned squid (*Illix illecebrosus*)	--	■	--	--
Cobia (*Rachycentron canadum*)	■	--	--	--
King mackerel (*Scomberomorus cavalla*)	■	--	--	--
Spanish mackerel (*Scomberomorus maculatus*)	■	--	--	--
Little tunny (*Euthynnus alletteratus*)	■	--	--	--
Bluefish (*Pomatomus saltatrix*)	--	■	--	--
Atlantic mackerel (*Scomber scombrus*)	--	■	--	--
Butterfish (*Peprilus triacanthus*)	--	■	--	--
Atlantic herring (*Clupea harengus*)	--	--	■	--
Small coastal sharks (5 species)	--	--	--	■
Large coastal sharks (17 species)	--	--	--	■
Pelagic sharks (6 species)	--	--	--	--
Wahoo (*Acanthocybium solandri*)	■	--	--	--
Dolphin (*Coryphaena hippurus*)	■	--	--	--
Tunas and billfishes (Scombridae, Istiophoridae, Xiphiidae)	--	--	--	■

MAFMC = Mid-Atlantic Fisheries Management Council; NEFMC = New England Fishery Management Council; NMFS = (Highly Migratory Species Office of the) National Marine Fisheries Service; SAFMC = South Atlantic Fishery Management Council.

Descriptions of EFH for managed plant, invertebrate, and fish species are organized similarly to the information presented above on fish resources into broad habitat classes of demersal and pelagic. Managed species and species groups for demersal and pelagic habitats are listed in **Table C-33** for each management council or NMFS.

Members of these fish groups occur in the Atlantic Program Area for at least a portion of their life cycles. The following accounts briefly describe the EFH and HAPCs for these species and life stages as outlined by the management entities.

8.3.1.1. Demersal Resources

Coral, Coral Reefs, and Live/Hard Bottom Habitats

For the SAB in the Atlantic Program Area, EFH for ahermatypic corals, black corals (*Antipatharia*), octocorals, and sea pens is as follows:

- Ahermatypic stony corals – defined hard substrate in subtidal to outer shelf depths throughout the management area.
- Black corals – rough, hard, exposed, stable substrate, offshore in high salinity (30 to 35 ppt) waters in depths >18 m (54 ft), not restricted by light penetration on the outer shelf throughout the SAB.
- Octocorals, excepting the order Pennatulacea (sea pens and sea pansies) – rough, hard, exposed, stable substrate in subtidal to outer shelf depths within a wide range of salinities and light penetration throughout the SAB.
- Pennatulacea (sea pens and sea pansies) – includes muddy, silty bottoms in subtidal to outer shelf depths within a wide range of salinities and light penetration throughout the SAB.

The HAPCs for coral, coral reefs, and live/hard bottom habitats of the Atlantic Program Area include the following: 10-Fathom Ledge, Big Rock, and the Point (North Carolina); Hurl Rocks and the Charleston Bump (South Carolina); Gray's Reef National Marine Sanctuary (NMS) (Georgia); the *Phragmatopoma* (tube worm) reefs off the central Atlantic coast of Florida; Oculina Bank off the Atlantic coast of Florida from Fort Pierce to Cape Canaveral; and nearshore (0 to 4 m [0 to 12 ft]) hard bottom off the Atlantic coast of Florida from Cape Canaveral to Broward County (SAFMC, 1998).

Spiny Lobster

Spiny lobster EFH consists of hard bottom, coral reefs, crevices, cracks, and other structured bottom in shelf waters of the Program Area from Cape Canaveral to Cape Fear, North Carolina. The Gulf Stream provides an important mode of transport for early life history stages of spiny lobster. No HAPCs for spiny lobster were identified within the Atlantic Program Area.

Hard Bottom Fishes (Snapper-Grouper Complex)

The reef fish (snapper-grouper) management unit consists of 73 species from 10 families. Only the most important species of snapper, grouper, porgy, temperate bass, and tilefish families are listed in **Table C-34**. Families not listed in the table are grunts, jacks, spadefishes, wrasses, and triggerfishes. The EFH for adults of this species group consists of hard bottom features such as live bottom, artificial reefs, coral reefs, and rocky outcrops. These features extend from nearshore out to at least 800-m (2,625-ft) water depths on the upper continental slope (SAFMC, 1998). Many of the early life stage individuals of reef fishes such as gag grouper, gray snapper (*Lutjanus griseus*), lane snapper (*L. synagris*), and scup (*Stenotomus chrysops*) have EFH in inshore waters not present in the Program Area. Although the fisheries and adult habitat of these species exist primarily within the SAB portion of the Program Area, three species (black sea bass [*Centropristis striata*], scup, and tilefish [*Lopholatilus chamaeleonticeps*]) are also managed by the MAFMC and have EFH in the MAB as well (SAFMC, 1998; MAFMC, 2008a).

The HAPCs for the reef fish species complex in the Atlantic Program Area include mangrove habitat, seagrass habitat, oyster/shell habitat, and all coastal inlets (SAFMC, 1998). Areas that meet the criteria for EFH-HAPCs for species in the snapper-grouper management unit include medium- to high-profile offshore hard bottoms where spawning normally occurs; localities of known or likely periodic spawning aggregations; nearshore hard bottom areas; The Point, Ten Fathom Ledge, and Big Rock

(North Carolina); Charleston Bump (South Carolina); mangrove habitat; seagrass habitat; oyster/shell habitat; all coastal inlets; all state-designated nursery habitats of particular importance to snappers-groupers (e.g., primary and secondary nursery areas designated in North Carolina); pelagic and benthic *Sargassum*; Hoyt Hills for wreckfish; the Oculina Bank HAPC; all hermatypic coral habitats and reefs; manganese outcroppings on the Blake Plateau; and Council-designated Artificial Reef Special Management Zones (SAFMC, 1998).

Table C-34. Hard Bottom Species with EFH Identified Within the Atlantic Program Area (Modified From: MAFMC, 1998a, 2008a; SAFMC, 1998).

Species	Eggs and Larvae	Juveniles	Adults
Spiny lobster (*Panulirus argus*)	Surface waters of the SAB and Gulf Stream	Not in Program Area	Live/hard bottom and artificial reefs with medium- to high-profile outcroppings from nearshore to at least 100 m (328 ft) water depths from Cape Hatteras, NC to Cape Canaveral, FL
Black sea bass (*Centropristis striata*)	Surface waters of the Atlantic Program Area shelf from May to October	Demersal soft and hard bottom habitats of the Atlantic Program Area shelf where water temperatures are >6°C (42.8º F) and salinity >18 ppt	Demersal soft and hard bottom habitats of the Atlantic Program Area shelf where water temperatures are >6°C (42.8º F) and salinity >18 ppt
Warsaw grouper (*Epinephelus nigritus*)	Surface waters of the SAB and Gulf Stream including pelagic *Sargassum*	Live/hard bottom and artificial reefs with medium to high profile outcroppings from inner shelf to at least 200 m (656 ft) water depths	Live/hard bottom and artificial reefs with medium to high profile outcroppings from 50 m (164 ft) to at least 200 m (656 ft) water depths; spawning occurs in the same area
Snowy grouper (*Epinephelus niveatus*)	Surface waters of the SAB and Gulf Stream including pelagic *Sargassum*	Live/hard bottom and artificial reefs with medium to high profile outcroppings from inner shelf to at least 200 m (656 ft) water depths	Live/hard bottom and artificial reefs with medium to high profile outcroppings from 50 m (164 ft) to at least 200 m (656 ft) water depths. Spawning occurs in the same area
Gag grouper (*Mycteroperca microlepis*)	Surface waters of the SAB and Gulf Stream including pelagic *Sargassum*	Not in Atlantic Program Area	Live/hard bottom and artificial reefs with medium to high profile outcroppings from nearshore to at least 100 m (328 ft) water depths from Cape Hatteras, NC, to Cape Canaveral, FL; spawning occurs in winter months in 30 to 100 m (98 to 328 ft) depths
Scamp (*Mycteroperca phenax*)	Surface waters of the SAB and Gulf Stream including pelagic *Sargassum*	Hard bottom areas on the shelf to the shelf edge from Cape Hatteras, NC to Cape Canaveral, FL	Hard bottom areas from Cape Hatteras, NC to Cape Canaveral, FL

Table C-34. Hard Bottom Species with EFH Identified Within the Atlantic Program Area (Modified From: MAFMC, 1998a, 2008a; SAFMC, 1998) (Continued).

Species	Eggs and Larvae	Juveniles	Adults
Wreckfish (*Polyprion americanus*)	Gulf Stream waters including pelagic *Sargassum*	Not enough information	Live/hard bottom and artificial reefs with medium to high profile outcroppings in 800 to 1,200 m (2,625 to 3,937 ft) water depths
Gray snapper (*Lutjanus griseus*)	Surface waters of the SAB and Gulf Stream	Hard bottom and soft bottom areas on the shelf from Cape Hatteras, NC, to Cape Canaveral, FL	Hard bottom areas from Cape Hatteras, NC to Cape Canaveral, FL
Red snapper (*Lutjanus campechanus*)	Surface waters of the SAB and Gulf Stream	Not in Atlantic Program Area	Hard bottom areas from Cape Hatteras, NC to Cape Canaveral, FL
Lane snapper (*Lutjanus synagris*)	Surface waters of the SAB and Gulf Stream	Not in Atlantic Program Area	Hard bottom areas from Cape Hatteras, NC to Cape Canaveral, FL
Vermilion snapper (*Rhomboplites aurorubens*)	Surface waters of the SAB and Gulf Stream	Hard bottom areas on the shelf to the shelf edge from Cape Hatteras, NC, to Cape Canaveral, FL	Hard bottom areas from Cape Hatteras, NC to Cape Canaveral, FL
Scup (*Stenotomus chrysops*)	Not in Atlantic Program Area	Not in Atlantic Program Area	Demersal waters of the continental shelf off the middle Atlantic south to Cape Hatteras, NC
Blueline tilefish (*Caulolatilus microps*)	Gulf Stream waters including pelagic *Sargassum*	Not enough information	Soft or rough bottom in water depths between 100 and 400 m (328 and 1,312 ft)
Tilefish (*Lopholatilus chamaleonticeps*)	Water column on the outer continental shelf and slope throughout the Atlantic Program Area boundary in temperatures between 7.5°C (45.5º F) and 17.5°C (63.5º F)	Semi-lithified clay substrate on the outer continental shelf and slope throughout the Atlantic Program Area in bottom water temperatures which range from 9°C (48.2º F) to 14°C (59º F), in depths between 100 and 300 m	Semi-lithified clay substrate on the outer continental shelf and slope throughout the Program Area in bottom water temperatures ranging from 9°C (48.2º F) to 14°C (57.2º F), in depths between 100 and 300 m (328 and 984 ft)

Mollusks

Four bivalve mollusk species managed by federal agencies occur in the Atlantic Program Area: surfclam (*Spisula solidissima*), ocean quahog (*Arctica islandica*), sea scallop (*Placopecten magellanicus*), and calico scallop (*Argopecten gibbus*). The surfclam and ocean quahog occur in shelf waters of the MAB portion of the Atlantic Program Area. The sea scallop is most abundant north of the Atlantic Program Area, but the southern portion of its distribution extends into the MAB (NEFMC, 1998a). **Table C-35** gives EFH information for these species in the Program Area. The calico scallop occurs in clusters in the SAB primarily offshore of Cape Canaveral, Florida, Cape Fear, North Carolina, and the Georgia-South Carolina border (SAFMC, 1998). HAPCs were not designated for any of these mollusk species.

Table C-35. Soft Bottom Species and Life Stages with EFH Identified Within the Atlantic Program Area (Modified From: MAFMC, 1998b, 2008a; NEFMC, 1998a,b,c; 2002; SAFMC, 1998).

Species	Eggs and Larvae	Juveniles	Adults
Surfclam (*Spisula solidissima*)	Not enough information	In substrate, to a depth of 1 m (3.3 ft) below the water/sediment surface throughout the MAB from the shoreline to 70 m (158 ft) depth	In substrate, to a depth of 1 m (3.3 ft) below the water/sediment surface throughout the MAB from the shoreline to 70 m (158 ft) depth
Ocean quahog (*Arctica islandica*)	Not enough information	In substrate, to a depth of 1 m (3.3 ft) below the water/sediment surface throughout the MAB in water depths from 33 to 244 m (108 to 800.5 ft)	In substrate, to a depth of 1 m (3.3 ft) below the water/sediment surface throughout the MAB from the shoreline to 10 to 244 m depth (108 to 800.5 ft)
Sea scallop (*Placopecten magellanicus*)	Bottom habitats in the middle Atlantic south to the Virginia-North Carolina border; eggs are heavier than seawater and remain on the seafloor until they develop into the first free-swimming larval stage. Generally, eggs are thought to occur where water temperatures are <17°C (62.6º F). Larvae occur in pelagic waters and bottom habitats with a substrate of gravelly sand, shell fragments, and pebbles, or on various red algae, hydroids, amphipod tubes, and bryozoans in the MAB south to the Virginia-North Carolina border where sea surface temperatures are <18°C (64.4º F) and salinities are between 16.9 and 30 ppt.	Bottom habitats with a substrate of cobble, shells, and silt in the middle Atlantic south to the Virginia/North Carolina border where water temperatures are <15°C (59 ft) and water depths range from 18 to 110 m (59 to 361 ft)	Bottom habitats with a substrate of cobble, shells, coarse/gravelly sand, and sand in the middle Atlantic south to the Virginia-North Carolina border where water temperatures are <21°C (69.8º F), water depths range from 18 to 110 m (59 to 361 ft), and salinities are >16.5 ppt. Spawning occurs from May through October, with peaks in May and June
Calico scallop (*Argopecten gibbus*)	Not enough information	Unconsolidated sediments including hard sand bottoms, sand and shell hash, quartz sand, smooth sand-shell-gravel, and sand and dead shell in 13 to 94 m (42.7 to 308 ft) of water, with concentrations occurring off Cape Canaveral, FL (Stuart to St. Augustine) and sporadically off Cape Lookout, NC, in 19 to 31 m (62 to 102 ft) of water, and offshore of the South Carolina/Georgia border in 37 to 45 m (121 to 148 m) of water	Unconsolidated sediments including hard sand bottoms, sand and shell hash, quartz sand, smooth sand-shell-gravel, and sand and dead shell in 13 to 94 m (42.7 to 308 ft) of water, with concentrations occurring off Cape Canaveral, FL (Stuart to St. Augustine), and sporadically off Cape Lookout, NC, in 19 to 31 m (62 to 102 ft) of water, and offshore of the South Carolina/Georgia border in 37 to 45 m (121 to 148 m) of water

Table C-35. Soft Bottom Species and Life Stages with EFH Identified Within the Atlantic Program Area (Modified From: MAFMC, 1998b, 2008a; NEFMC, 1998a,b,c; 2002; SAFMC, 1998) (Continued).

Species	Eggs and Larvae	Juveniles	Adults
Golden crab (*Chaceon fenneri*)	Eggs are brooded attached to the underside of the female crab until they hatch into larvae and are released into the water column. Egg-bearing females are most commonly found on the shallow continental slope between 300 and 600 m (984 and 1,968 ft) depth; larvae occur in pelagic waters of the Gulf Stream	Soft bottom including foraminiferal ooze, dead coral mounds, dunes, and black pebble habitat in water depths of 367 to 549 m (1,204 to 1,801 ft)	Soft bottom including foraminiferal ooze, dead coral mounds, dunes, and black pebble habitat in water depths of 367 to 549 m (1,204 to 1,801 ft)
Red crab (*Chaceon quinquedens*)	Eggs are brooded attached to the underside of the female crab until they hatch into larvae and are released into the water column. Egg-bearing females are most commonly found on the shallow continental slope to Cape Hatteras, NC between 200 and 400 m (656 and 1,312 ft) depth where temperatures are typically between 4°C (39.2º F) and 10°C (50º F) and water depths range from 200 to 400 m (656 and 1,312 ft). Larvae occur in the water column from the surface to the seafloor from 200 to 1,800 m (656 to 5,905 ft) depth along the MAB south to Cape Hatteras, NC where water temperatures range between 4°C (39.2º F) and 25°C (77º F), salinities are between 29 and 36 ppt, and dissolved oxygen is between 5 and 8 mg/L; larvae appear to be most common during January through June	Bottom habitats of the continental slope with a substrate of silts, clays, and all silt-clay-sand composites within the depths of 700 to 1,800 m (2,297 to 5,905 ft) along the southern flank of Georges Bank and south to Cape Hatteras, NC, where water temperatures are between 4°C (39.2º F) and 10°C (50º F), and salinities are approximately 35 ppt, and dissolved oxygen ranges between 3 and 7 mg/L	Bottom habitats of the continental slope with a substrate of silts, clays, and all silt-clay-sand composites within the depths of 200 to 1,300 m (656 to 4,265 ft) along the southern flank of Georges Bank and south to Cape Hatteras, NC where water temperatures are between 5°C (41º F) and 14°C (57.2º F), salinities average 35ppt, and dissolved oxygen ranges between 3 and 8 mg/L
Royal red shrimp (*Pleoticus robustus*)	Pelagic Gulf Stream waters	Soft bottom including blue/black mud, sand, muddy sand, and white calcareous mud on the upper continental slope in water depths of 180 to 475 m (590 to 1,558 ft)	Soft bottom including blue/black mud, sand, muddy sand, and white calcareous mud on the upper continental slope in water depths of 180 to 475 m (590 to 1,558 ft)

Table C-35. Soft Bottom Species and Life Stages with EFH Identified Within the Atlantic Program Area (Modified From: MAFMC, 1998b, 2008a; NEFMC, 1998a,b,c; 2002; SAFMC, 1998) (Continued).

Species	Eggs and Larvae	Juveniles	Adults
Rock shrimp (*Syconia* spp.)	Eggs and larvae in high salinity coastal waters of the SAB	Terrigenous and biogenic sand bottom habitats from 18 to 182 m (59 to 597 ft) in depth with highest concentrations occurring between 34 and 55 m (112 and 180 ft) in all areas from NC to Cape Canaveral, FL	Terrigenous and biogenic sand bottom habitats from 18 to 182 m (59 to 597 ft) in depth with highest concentrations occurring between 34 and 55 m (112 and 180 ft) in areas from North Carolina to Cape Canaveral, FL; spawning occurs in the same area
Brown shrimp (*Farfantepenaeus aztecus*)	Eggs and larvae in high salinity coastal waters of the SAB	Not in Atlantic Program Area (primarily in inshore waters)	Nearshore SAB shelf with medium- to fine-grained sediment; spawning occurs offshore
Pink shrimp (*Farfantepenaeus duorarum*)	Eggs and larvae in high salinity coastal waters of the SAB	Not in Atlantic Program Area (primarily in inshore waters)	Coarse and particularly calcareous bottom sediments in SAB from mid- to outer shelf depths; spawning occurs offshore
White shrimp (*Litopenaeus setiferus*)	Eggs and larvae in high salinity coastal waters of the SAB	Not in Atlantic Program Area (primarily in inshore waters)	Nearshore SAB shelf with medium- to fine-grained sediment
Monkfish (*Lophius americanus*)	MAB shelf areas south to Cape Hatteras, NC, with water temperatures <15°C (59º F) and depths from 15 to 1,000 m (49 to 3,281 ft) for eggs and from 25 to 1,000 m (82 to 3,280 ft) for larvae; egg veils and larvae are most often observed from March to September	MAB shelf areas with water temperatures <13°C (55.4º F), depths from 25 to 200 m (82 to 656 ft), and a salinity range from 29.9 to 36.7 ppt	Bottom habitats with substrates of a sand-shell mix, algae covered rocks, hard sand, pebbly gravel, or mud along the outer MAB shelf

Table C-35. Soft Bottom Species and Life Stages with EFH Identified Within the Atlantic Program Area (Modified From: MAFMC, 1998b, 2008a; NEFMC, 1998a,b,c; 2002; SAFMC, 1998) (Continued).

Species	Eggs and Larvae	Juveniles	Adults
Offshore hake (*Merluccius albidus*)	MAB shelf to Cape Hatteras, NC where water temperatures <20°C (68º F) and water depths <1,250 m (4,101 ft) all year at depths from 110 to 270 m (361 to 886) (eggs) and from 70 to 130 m (230 to 427 ft) (larvae)	Bottom habitats along the outer MAB shelf south to Cape Hatteras, NC, generally where water temperatures are <12°C (53.6º F) and depths range from 170 to 350 m (558 to 1,148 ft)	Bottom habitats along the outer MAB shelf south to Cape Hatteras, NC, where water temperatures are <12°C (53.6º F) and depths range from 150 to 380 m (483 to 1,247 ft). Spawning occurs throughout the year at depths from 330 to 550 m (1,083 to 1,804 ft)
Silver hake (*Merluccius bilinearis*)	Surface waters of the MAB south to Cape Hatteras where sea surface temperatures are <20°C (68º F) and water depths are 50 to 130 m (164 to 427 ft); larvae are observed all year, with peaks from July through September	Bottom habitats of all substrate types on the MAB shelf south to Cape Hatteras, NC, where water temperatures are <21°C (69.8º F), water depths 20 to 270 m (65.6 to 886 ft), and salinities are >20 ppt	Bottom habitats of all substrate types on the MAB shelf south to Cape Hatteras, NC, where water temperatures are <22°C (71.6º F) and depths between 30 and 325 m (98 and 1,066 ft). Spawning occurs in the same area where water temperatures are <13°C (55.4º F)
Red hake (*Urophycis chuss*)	Continental shelf off the MAB south to Cape Hatteras, NC, where sea surface temperatures are <10°C (50º F) along the inner shelf (eggs) or 19°C (66.2º F) in water depths <200 m (656 ft) (larvae), in a salinity >0.5 ppt; May through November (eggs) to December (larvae), with peaks in June and July (eggs) and September-October (larvae)	Bottom habitats with a substrate of shell fragments, including areas with an abundance of live scallops on the shelf off the middle Atlantic south to Cape Hatteras, NC, where water temperatures are <16°C (60.8º F), depths are <100 m (328 ft), and salinity ranges from 31 to 33 ppt	Bottom habitats in depressions with a substrate of sand and mud on the continental shelf off the middle Atlantic south to Cape Hatteras, NC, where water temperatures are <12°C (53.6º F), water depths range from 10 to 130 m (32.8 to 427 ft), and salinity ranges from 33 to 34 ppt. Spawning occurs in water depths <100 m (328 ft) and salinity <25 ppt from May to November, with peaks in June and July

Table C-35. Soft Bottom Species and Life Stages with EFH Identified Within the Atlantic Program Area (Modified From: MAFMC, 1998b, 2008a; NEFMC, 1998a,b,c; 2002; SAFMC, 1998) (Continued).

Species	Eggs and Larvae	Juveniles	Adults
Witch flounder (*Glyptocephalus cynoglossus*)	Surface waters to 250 m (820 ft) on the MAB shelf off the middle Atlantic south to Cape Hatteras, NC, where sea surface temperatures are <13°C (55.4º F) over deep water with high salinities; larvae are most often observed from March through November, with peaks in May to July	Bottom habitats with a fine-grained substrate along the outer MAB shelf south to Cape Hatteras, NC, where water temperatures are <13°C (55.4º F), depths range from 50 to 450 m (164 to 1,476 ft), and salinity ranges from 34 to 36 ppt	Bottom habitats with a fine-grained substrate along the outer MAB continental shelf south to Chesapeake Bay, where water temperatures are <13°C (55.4º F), depths range from 25 to 300 m (82 to 984 ft), and salinity ranges from 32 to 36 ppt. Spawning occurs from March through November, with peaks in May to August
Summer flounder (*Paralichthys dentatus*)	Surface waters of the MAB shelf south to Cape Canaveral, FL; in water depths from shore to 98 m (322 ft) (eggs) and from 10 to 70 m (32.8 to 230 ft) (larvae)	Demersal waters of the MAB shelf south to Cape Canaveral, FL, to water depths of 152 m (499 ft)	Demersal waters of the MAB shelf south to Cape Canaveral, FL, to water depths of 152 m (488 ft). Spawning occurs between October and May
Windowpane flounder (*Scophthalmus aquosus*)	Pelagic waters of the MAB south to Cape Hatteras, NC where sea surface temperatures are <20°C (6º8 F) and water depths <70 m (230 ft); eggs and larvae are often observed from February to November with peaks in May and October	Bottom habitats with a substrate of mud or fine-grained sand on the MAB shelf south to Cape Hatteras, NC, where water temperatures are <25°C (77º F), depths range from 1 to 100 m (3.3 to 328 ft), and salinities range between 5.5 and 36 ppt	Bottom habitats with a substrate of mud or fine-grained sand on the MAB shelf south to the Virginia-North Carolina border where water temperatures are <26.8°C (80.2º F), depths range from 1 to 75 m (3.3 to 246 ft), and salinities range between 5.5 and 36 ppt. Spawning occurs from February to December with a peak in May

MAB = Mid-Atlantic Bight; SAB = South Atlantic Bight.

Shrimps

Penaeid shrimps managed by the SAFMC and occurring in the Program Area are brown shrimp, pink shrimp, and white shrimp. Other members of this management unit important to fisheries of the region include rock shrimp and royal red shrimp. **Table C-35** presents EFH information for life stages of these species within the Atlantic Program Area.

The HAPCs for penaeid, rock, and royal red shrimps include all state-designated habitat of particular importance to shrimp and state-designated overwintering areas.

Crabs

Two deep-dwelling crabs of the family Geryonidae occur in the Program Area. The red crab (*Chaceon quinquedens*) is most abundant in the MAB and north (NEFMC, 2002), whereas the golden crab (*C. fenneri*) is most abundant in the SAB (SAFMC, 1998). **Table C-35** provides EFH information for life stages of the red and golden crabs for the Atlantic Program Area. HAPCs have not been identified for red crab (NEFMC, 2002) or golden crab (SAFMC, 1998).

8.3.1.2. Pelagic Resources

Sargassum

The brown alga *Sargassum* floats at the sea surface, often forming large mats. These accumulations attract numerous small fishes and invertebrates that become mobile epipelagic assemblages. Larger fishes, particularly dolphinfish, tunas, billfishes, and wahoo, associate with *Sargassum* mats in search of prey and possibly shelter (SAFMC, 1998, 2002, 2003). Some fish families, including jacks, triggerfishes (Balistidae), filefishes (Monacanthidae), and drift fishes (Stromateidae), use *Sargassum* as nursery habitat. The EFH and HAPC for *Sargassum* comprises the shelf waters and the Gulf Stream to the limits of the EEZ.

Squids

Two squid taxa support fisheries in the MAB portion of the Atlantic Program Area: long-finned squid and shortfin squid (*Illex* spp.), a complex of closely related species nominally referred to as *Illex illecebrosus*. Long-finned squid, a member of the family Loliginidae, occurs primarily in shelf and shelf edge waters. Adults move offshore in fall and remain there until April, when adults and young migrate back into shelf waters for the summer (Lange and Sissenwine, 1980). Spawning reportedly occurs year-round with major peaks in spring (April and May) and fall (August and September). Eggs are attached to hard surfaces and vegetation (NEFMC, 1998a). The shortfin squid belongs to the Family Ommastrephidae, which consists entirely of oceanic species. It is distributed accordinglshy in oceanic and shelf-edge waters of the MAB to Cape Hatteras, North Carolina (Lange and Sissenwine, 1980). It migrates into shallower waters (10 to 50 m [33 to 164 ft]) during summer months; in late fall it moves south and offshore in the area from Georges Bank to Cape Hatteras (Lange and Sissenwine, 1980).

8.3.2.3. Coastal Pelagic Fishes

The coastal pelagic category is used formally by the SAFMC to define a management unit including cobia, Spanish mackerel, king mackerel, and little tunny (*Euthynnus alletteratus*) (SAFMC, 1998). Other managed species that inhabit the coastal pelagic habitat of the Program Area include coastal sharks (small and large), managed by NMFS (2009a); spiny dogfish (*Squalus acanthias*), managed by MAFMC and NEFMC (1999); and Atlantic herring (*Clupea harengus*), Atlantic mackerel (*Scomber scombrus*), butterfish (*Peprilus triacanthus*), and bluefish (*Pomatomus saltatrix*), managed by MAFMC (1998c, 2008b). Specific EFH information for these species is presented in **Table C-36**.

Table C-36. Coastal Pelagic Species and Life Stages with EFH Identified Within the Atlantic Program Area (Modified From: MAFMC, 1998c, 2008b; SAFMC, 1998).

Species	Eggs and Larvae	Juveniles	Adults
Longfin squid (*Loligo pealei*)	Coastal and offshore bottom habitats from Georges Bank southward to Cape Hatteras, NC; egg masses are found attached to rocks and boulders on sand or mud bottom, as well as attached to aquatic vegetation where bottom water temperatures range between 10°C (50º F) and 23°C (73.4º F), salinities range from 30 to 32 ppt, and depths are <50 m (164 m)	Pelagic waters of the continental shelf from the Gulf of Maine through Cape Hatteras, NC, from shore to 213 m (699 ft) water depth in temperatures ranging from 3.8°C (38.8º F) to 27°C (80.6º F)	Pelagic waters of the continental shelf from the Gulf of Maine through Cape Hatteras, NC, from shore to 305 m (1,000 ft) water depth in temperatures ranging from 3.8°C (38.8º F) to 27°C (80.6º F)
Shortfin squid (*Illex illecebrosus*)	NA	Pelagic waters of the continental shelf from the Gulf of Maine through Cape Hatteras, NC, from shore to 183 m (600 ft) water depth in temperatures ranging from 2.2°C (36º F) to 22.8°C (73º F)	Pelagic waters of the continental shelf from the Gulf of Maine through Cape Hatteras, NC, from shore to 183 m (600 ft) water depths in temperatures ranging from 3.8°C (38.8º F) to 19°C (66.2º F)
Atlantic herring (*Clupea harengus*)	Not in Atlantic Program Area	Pelagic waters and bottom habitats in the MAB south to Cape Hatteras, NC. Generally, the following conditions exist where Atlantic herring juveniles are found: water temperatures <10°C (50º F), water depths from 15 to 135 m (49 to 443 ft), and a salinity range from 26 to 32 ppt	Pelagic waters and bottom habitats in the MAB south to Cape Hatteras, NC. Generally, the following conditions exist where Atlantic herring adults are found: water temperatures <10°C (50º F), water depths from 20 to 130 m (65.6 to 427 ft), and salinity above 28 ppt
Cobia (*Rachycentron canadum*)	Pelagic waters of SAB and MAB from shore to the shelf edge	Shelf waters of SAB and MAB; artificial and natural hard bottom; associates with larger nekton (i.e., sharks, rays, sea turtles)	Shelf waters of SAB and MAB; artificial and natural hard bottom structures; associates with larger nekton (i.e., sharks, rays, sea turtles)
King mackerel (*Scomberomorus cavalla*)	Pelagic waters of SAB and MAB from shore to the shelf edge	Shelf waters of SAB and MAB; associates with artificial and natural hard bottom	Shelf waters of SAB and MAB; associates with artificial and natural hard bottom
Spanish mackerel (*Scomberomorus maculatus*)	Pelagic waters of SAB and MAB from shore to the shelf edge	Shelf and inshore waters of SAB and MAB; associates with artificial and natural hard bottom	Shelf and inshore waters of SAB and MAB; associates with artificial and natural hard bottom
Little tunny (*Euthynnus alletteratus*)	Pelagic waters of SAB and MAB from shore to beyond the shelf edge	Shelf waters of MAB and SAB; associates with artificial and natural hard bottom	Shelf waters of MAB and SAB; associates with artificial and natural hard bottom
Atlantic mackerel (*Scomber scomber*)	Shelf waters of MAB from Maine to Cape Hatteras, NC	Shelf waters of MAB from Maine to Cape Hatteras, NC to 320 m (1,050 ft) depth	Shelf waters from Maine to Cape Hatteras, NC to 320 m (1,050 ft) depth

Table C-36. Coastal Pelagic Species and Life Stages with EFH Identified Within the Atlantic Program Area (Modified from: MAFMC, 1998c, 2008b; SAFMC, 1998) (Continued).

Species	Eggs and Larvae	Juveniles	Adults
Bluefish (*Pomatomus saltatrix*)	Shelf waters of MAB from Maine to Cape Hatteras, NC	Estuaries and coastal waters of the Atlantic Program Area	Shelf and inshore waters of SAB and MAB
Butterfish (*Peprilus triacanthus*)	Pelagic waters of MAB from shore to beyond the shelf edge where temperatures range from 11°C (51.8°F) to 17°C (62.6°F)	Pelagic waters of MAB from shore to beyond the shelf edge where temperatures are 11°C (51.8º F) to 20°C (68º F) and water depths range from 10 to 366 m (32.8 to 1,201 ft)	Pelagic waters of MAB from shore to beyond the shelf edge where temperatures are 3°C (37.4º F) to 28°C (82.4º F) and water depths range from 10 to 366 m (32.8 to 1,201 ft)
Spiny dogfish (*Squalus acanthias*)	Does not apply	Shelf waters of the entire Atlantic Program Area to water depths of 390 m (1,280 ft) where temperatures range from 3°C (37.4º F) to 28ºC (82.4º F)	Shelf waters of the entire Atlantic Program Area to water depths of 450 m (1,476 ft) where temperatures range from 3°C (37.4º F) to 28ºC (82.4º F)

MAB = Mid-Atlantic Bight; SAB = South Atlantic Bight.

The HAPCs designated for the SAFMC coastal pelagic species group within the Atlantic Program Area include sandy shoals of Cape Lookout, Cape Fear, and mid-Cape Hatteras, The Point, The Ten-fathom Ledge, and Big Rock (North Carolina); The Charleston Bump and Hurl Rocks (South Carolina); and nearshore hard bottom (Florida) (SAFMC, 1998). For the species managed by the MAFMC and NMFS, no HAPCs have been designated.

There are five small coastal sharks with EFH in the Program Area: Atlantic angel shark (*Squatina dumeril*), bonnethead shark (*Sphyrna tiburo*), Atlantic sharpnose shark (*Rhizoprionodon terraenovae*), blacknose shark (*Carcharhinus acronotus*), and finetooth shark (*C. isodon*). **Table C-37** provides details for each species and life stage.

Large coastal sharks are those species commonly occurring in shelf waters. Seventeen large coastal shark species including basking shark (*Cetorhinus maximus*), great hammerhead shark (*Sphyrna mokarran)*, great white shark (*Carcharodon carcharias*), blacktip shark (*Carcharhinus limbatus*), bull shark, lemon shark, tiger shark (*Galeocerdo cuvier*), and sand tiger shark occur in the Program Area (USDOC, NMFS, 2009a). The HAPCs were not identified for small or large coastal sharks (USDOC, NMFS, 2009a).

Table C-37. Small Coastal Shark Species and Life Stages with EFH Identified Within the Atlantic Program Area (Modified From: USDOC, NMFS, 2009a).

Species	Neonate/Early Juveniles	Late Juveniles/Subadults	Adults
Angel shark (*Squatina dumerili*)	Off the coast of southern New Jersey, Delaware, and Maryland from 39° to 38° N in shallow coastal waters out to the 25-m (82-ft) depth contour, including the mouth of Delaware Bay	Off the coast of southern New Jersey, Delaware, and Maryland from 39° to 38° N in shallow coastal waters out to the 25-m (82-ft) depth contour, including the mouth of Delaware Bay	Off the coast of southern New Jersey, Delaware, and Maryland from 39° to 38° N in shallow coastal waters out to the 25-m (82-ft) depth contour, including the mouth of Delaware Bay
Bonnethead shark (*Sphyrna tiburo*)	Shallow coastal waters, inlets, and estuaries <25 m (82-ft) deep from Jekyll Island, GA to just north of Cape Canaveral, FL	Shallow coastal waters, inlets, and estuaries <25 m (82 ft) deep from Cape Fear, NC to West Palm Beach, FL	Shallow coastal waters, inlets and estuaries from Cape Fear, NC to Cape Canaveral, FL
Atlantic sharpnose shark (*Rhizoprionodon terraenovae*)	Shallow coastal areas including bays and estuaries out to the 25-m (82-ft) depth contour from Daytona Beach, FL north to Cape Hatteras, NC	From Daytona Beach, FL, north to Cumberland Island, GA; Hilton Head Island, SC, north to Cape Hatteras, NC, out to the 25-m (82-ft) depth contour (slightly deeper – to the 50-m (164-ft) depth contour – off North Carolina)	From Cape May, NJ south to the North Carolina-South Carolina border; shallow coastal areas north of Cape Hatteras, NC, to the 25-m (82-ft) depth contour; south of Cape Hatteras between the 25- and 100-m (82- to 238-ft) depth contours; offshore St. Augustine, FL, to Cape Canaveral, FL, from inshore to the 100-m (328-ft) depth contour
Blacknose shark (*Carcharhinus acronotus*)	Shallow coastal waters <25 m (82-ft) deep from the Georgia-Florida border to Cape Canaveral, FL	Shallow coastal waters <25 m (82 ft) deep from the Georgia-Florida border to Cape Canaveral, FL	Shallow coastal waters to the 25-m (82-ft) depth contour from St. Augustine, FL south to Cape Canaveral, FL
Finetooth shark (*Carcharhinus isodon*)	Shallow coastal waters of South Carolina, Georgia, and Florida out to the 25-m (82-ft) depth contour from 33° to 30° N	Shallow coastal waters of South Carolina, Georgia, and Florida out to the 25-m (82-ft) depth contour from 33° to 30° N	Shallow coastal waters of South Carolina, Georgia, and Florida out to the 25-m (82-ft) depth contour from 33° to 30° N

8.3.2. Managed Fishes

8.3.2.1. Listed Species

Two marine fish species that occur in the Atlantic Program Area are currently listed as endangered: shortnose sturgeon (*Acipenser brevirostrum*) and Atlantic sturgeon. NMFS has jurisdiction over most marine and anadromous fishes listed under the ESA, including the species discussed here.

Shortnose Sturgeon (*Acipenser brevirostrum*)

Status (Endangered)

The shortnose sturgeon belongs to the family Acipenseridae and is one of several members of the family found exclusively in North America. This species was originally listed as endangered on March 11, 1967 (32 FR 4001) under the Endangered Preservation Act of 1966. Subsequently, NMFS prepared a recovery plan for the species under the ESA (63 FR 69613), and at present there are

19 Atlantic coast rivers considered to support DPSs (USDOC, NMFS, 1998b). Population declines were attributed to habitat loss or alteration, pollution, and incidental capture in nets set for other species.

Distribution

The shortnose sturgeon is primarily an estuarine and riverine species and rarely enters the coastal ocean adjacent to the Atlantic Program Area. Most of the river systems listed as DPSs are in North Carolina, South Carolina, Georgia, and northern Florida (USDOC, NMFS, 1998b). Although these systems drain into the estuaries or the coastal ocean portion of the Program Area, shortnose sturgeon have rarely been found in coastal or shelf waters (Dadswell et al., 1984; Moser and Ross, 1995; Collins and Smith, 1997). Collins and Smith (1997) reviewed available records and reported 39 individuals ranging from 60 to 100 cm (2 to 3.3 ft) total length caught offshore of South Carolina from January to March. Dadswell et al. (1984) reported eight records from the Atlantic Ocean between Cape Henry, Virginia, and Cape Fear, North Carolina.

Life History

The shortnose sturgeon is an anadromous species found in larger rivers and estuaries of the North America eastern seaboard from the St. Johns River in Florida to the St. Johns River in Canada. Although shortnose sturgeon occur primarily in fresh and estuarine waters, they occasionally will enter the coastal ocean. Adults ascend rivers to spawn from February to April; eggs are deposited over hard bottom, in shallow, fast-moving water (Dadswell et al., 1984; Murdy et al., 1997). Fecundity ranges from 27,000 to 208,000 eggs per female (Murdy et al., 1997). Growth is relatively slow, with females reaching maturity in 6 to 7 years, whereas males mature in 3 to 5 years. Shortnose sturgeon can live to be more than 67 years, with an average life span of 30 to 40 years.

Atlantic Sturgeon (*Acipenser oxyrinchus oxyrinchus*)

Status (Threatened–Gulf of Maine DPS; Endangered–New York Bight, Chesapeake Bay, Carolina, and South Atlantic DPSs)

In 2009, the National Resources Defense Council (NRDC, 2009) petitioned NMFS to list the Atlantic sturgeon as endangered under the ESA. The NRDC requested that the species be segregated into five DPSs, including Gulf of Maine, New York Bight, Chesapeake Bay, Carolina, and South Atlantic (**Figure C-77**). On February 6, 2012, NMFS issued final rules classifying the Gulf of Maine DPS as threatened and the other four DPSs, which are in the Atlantic Program Area, as endangered (77 FR 5880). These recent listings did not designate critical habitat due to a lack of information on individual DPSs.

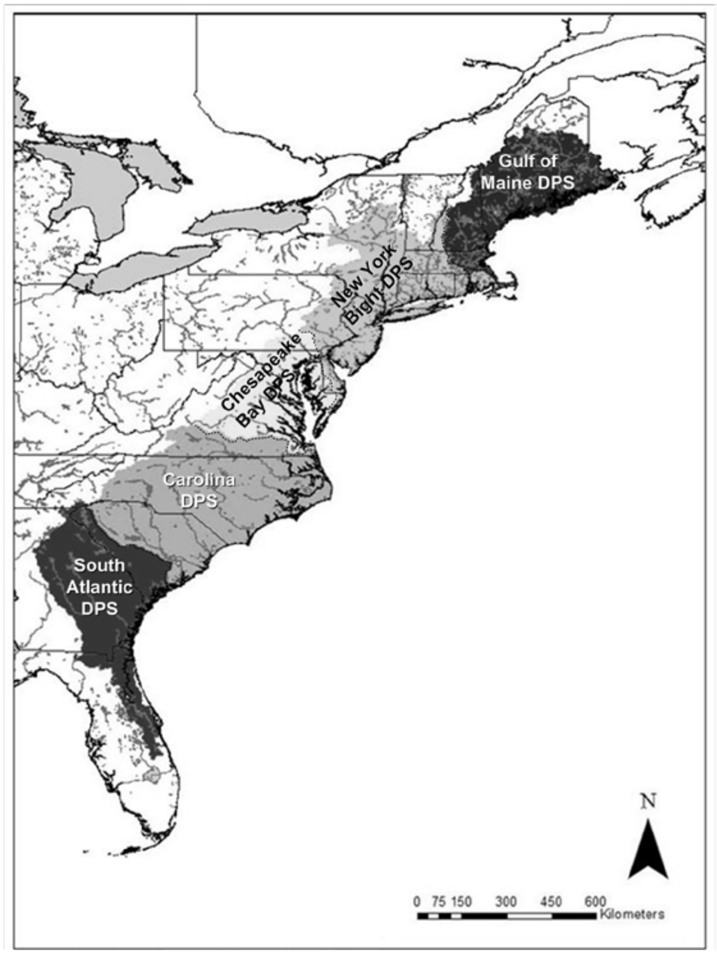


Figure C-77. Distinct Population Segments for the Atlantic Sturgeon (From: Atlantic Sturgeon Status Review Team, 2007).

Distribution

Historically, Atlantic sturgeon were distributed along the Atlantic Coast and inhabited 38 coastal rivers from the St. Johns River, Florida, to Hamilton Inlet, Labrador. Today they inhabit 32 coastal rivers over a reduced geographic range, with the center of abundance being the New York Bight (Atlantic Sturgeon Status Review Team, 2007; Dunton et al., 2010).

Life History

The Atlantic sturgeon is an anadromous species that resides for much of each year in estuarine and marine waters, but ascends coastal rivers in spring to spawn in freshwater. Spawning populations occur in 20 of the 32 Atlantic coast rivers that support Atlantic sturgeon. Atlantic sturgeon are generally slow growing and late maturing, and mature individuals may not spawn every year; generally, the range between spawning is 1 to 5 years. Spawning takes place in flowing freshwater. Depending on their size, mature females produce between 400,000 and 8 million eggs. The eggs are adhesive and attach to gravel or other hard substrata. Larvae develop as they move downstream to the estuarine portion of the spawning river, where they reside as juveniles for years. Subadults will move into coastal ocean waters where they may undergo extensive movements usually confined to shelly or gravelly bottoms in 10 to 50 m (33 to 164 ft) of water (Stein et al., 2004; Erickson et al., 2011). Fish distribution varies seasonally within this depth range. During summer months (May to September) fish are primarily found in the shallower depths of 10 to 20 m (33 to 66 ft). In winter and early spring (December to March), fish move to depths between 20 and 50 m (66 and 165 ft) (Erickson et al., 2011). Shelf areas <18 m (59 ft) deep off Virginia and the sandy shoals offshore of Oregon Inlet, North Carolina, appear to be areas of concentration during summer months (Laney et al., 2007). The area of high concentration offshore of Virginia was centered from 15 to 37.5 km (9.3 to 23.3 mi) from shore, and the maximum distance from shore during winter was approximately 113 km (70 mi). Although there is considerable intermingling of populations in the coastal oceans, adults return to their natal rivers to spawn. Adults grow to lengths of 4.3 m (14 ft) and weights of 363 kg (800 lb) and live for up to 60 years. Age at maturity varies with subpopulation but ranges from 5 to 10 years in South Carolina to 22 to 34 years in the St. Lawrence River, Canada.

9.0. AREAS OF SPECIAL CONCERN

Areas of special concern include federally managed areas such as Marine Protected Areas (MPAs), NMSs, National Parks, NWRs, National Estuarine Research Reserves (NERRs), National Estuary Program (NEP) sites, and state-designated MPAs that have been given special designations by federal and state agencies. This section discusses these areas of special concern as well as critical habitat for endangered species.

An MPA is defined by Executive Order (EO) 13158 as "any area of the marine environment that has been reserved by federal, state, territorial, tribal, or local laws or regulations to provide lasting protection for part or all of the natural and cultural resources therein." In practice, MPAs are areas where natural and/or cultural resources are given greater protection than in surrounding waters. In the U.S., MPAs span a range of habitats including the open ocean, coral reefs, deepwater habitats, coastal areas, intertidal zones, estuaries, and the Great Lakes, and can include freshwater or terrestrial areas. A national system of MPAs, established in 2008, was updated in 2015 as a nationwide program for the effective stewardship, conservation, restoration, sustainable use, understanding, and appreciation of marine resources. The national system currently includes 437 federal, state, and territorial MPAs covering an area of 494,765 km^2 (191,030 mi^2) (USDOC, NOAA, 2015a).

MPAs are designed to achieve a variety of goals generally falling into six categories: conservation of biodiversity and habitat, fishery management, research and education, enhancement of recreation and tourism, maintenance of marine ecosystems, and protection of cultural heritage.

9.1. ALASKA PROGRAM AREA

9.1.1. Beaufort Sea and Chukchi Sea Planning Areas

The Chukchi Sea Program Area includes the majority of the Chukchi Sea Planning Area and excludes Presidential Withdrawal Areas: a 40 km (25-mi) coastal buffer, a subsistence area, and Hanna Shoal (Figure 2.1-1 in the Programmatic EIS). The Beaufort Sea Program Area includes the majority of the Beaufort Sea Planning Area and excludes the Presidential Withdrawal Areas: the Barrow and Kaktovik subsistence bowhead whaling areas. The Alaska National Interest Lands Conservation Act of 1980 designated certain public lands in Alaska as units of the National Park, NWR, Wild and Scenic Rivers, National Wilderness Preservation, and National Forest Systems.

The following section describes federal lands managed by the NPS and USFWS, including MPAs, NERRs, NEP areas, Municipal Utility Authority's (MUAs), and NOAA-designated HCAs that could be impacted by oil and gas activities or associated spills. There are no USFS lands adjacent to the Chukchi Sea or Beaufort Sea Planning Areas.

9.1.1.1. Marine Protected Areas

There are five MPAs in the Beaufort and Chukchi Seas, two are National System members and three are eligible but are not currently members. The two National System MPAs are both NWRs (the Arctic

NWR and the Chukchi Sea Unit of the Alaska Maritime NWR) that could be affected by OCS oil and gas activities (**Section 9.1.1.1.2**) (**Figure C-78**). All coastal MPAs within the Beaufort Sea and Chukchi Sea Planning Areas and their locations are shown in **Figure C-78** and listed in **Table C-38**.

Both NWRs are classified as Natural and Cultural Heritage Conservation Areas and Sustainable Production Conservation Areas. Commercial fishing is prohibited in the Arctic NWR and is restricted in the Chukchi Sea Unit of the Alaska Maritime NWR. There are no state MPAs or de facto MPAs in the Beaufort Sea and Chukchi Sea Planning Areas (USDOC, NOAA, 2015).

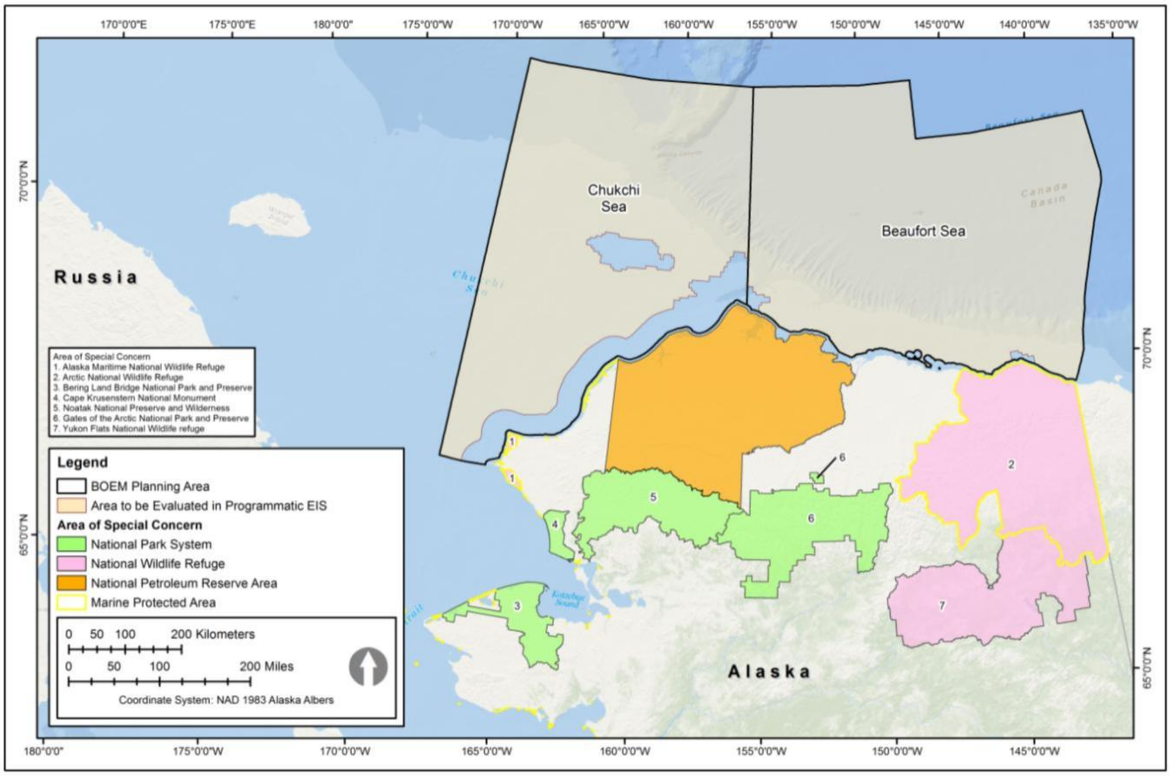


Figure C-78. Areas of Special Concern in and Adjacent to the Beaufort Sea and Chukchi Sea Planning Areas.

Table C-38. Areas of Special Concern in and Adjacent to the Beaufort Sea and Chukchi Sea Planning Areas.

No.	Name	Type	NSMPA	Federal/State	Region	Planning Area	State	EIA
1	Alaska Maritime NWR	NWR	Y	Fed	Alaska	Chukchi	AK	None
2	Arctic NWR	NWR	Y	Fed	Alaska	Beaufort	AK	None
3	Bering Land Bridge Park and Reserve	NPS	N	Fed	Alaska	Chukchi	AK	None
4	Cape Krusenstern National Monument	NPS	N	Fed	Alaska	Chukchi	AK	None
5	Noatak National Preserve and Wilderness	NPS	N	Fed	Alaska	Chukchi	AK	None
6	Gates of the Arctic Park and Preserve	NPS	N	Fed	Alaska	Chukchi	AK	None
7	Yukon Flats NWR	NWR	N	Fed	Alaska	Beaufort	AK	None

NSMPA = National System of Marine Protected Areas; EIA = Environmentally Important Areas; NWR = National Wildlife Refuge; NPS = National Park Service

9.1.1.1.1. National Park Service

There are three areas within or adjacent to the Beaufort Sea and Chukchi Sea Program Areas that are managed by the NPS: Iñupiat Heritage Center, Cape Krusenstern National Monument, and Bering Land Bridge National Preserve (**Figure C-78** and **Table C-38**). These could be affected by OCS oil and gas activities, including accidental spills (USDOI, NPS, 2015).

The Iñupiat Heritage Center in Barrow, Alaska is the only NPS-managed area along the coast of the Beaufort Sea and Chukchi Sea Planning Areas (**Figure C-78**). The Iñupiat Heritage Center is a museum that uses exhibits, classes, performances, and educational activities to promote and protect Iñupiaq culture, history, and language.

Cape Krusenstern National Monument is located along the northern shore of Hope Basin, approximately 150 km (93 mi) south of the Chukchi Planning Area and encompasses an area of 2,627 km^2 (1,014 mi^2). The area is primarily a coastal plain with large lagoons and limestone hills. The area is used by the Iñupiat for subsistence purposes.

Bering Land Bridge National Preserve encompasses an area of 10,916 km^2 (4,215 mi^2) located along the southern shore of Hope Basin, approximately 300 km (186 mi) south of the Chukchi Sea Planning Area (**Figure C-78**). The preserve protects a remnant of the Bering Land Bridge that once connected Asia with North America. It contains lava flows, lake-filled maars (volcanic craters), and hot springs. Most of the land is tundra supporting caribou (*Rangeifer tarandus*), muskoxen (*Ovibos moschatus*), brown bears (*Ursus arctos*), red fox (*Vulpes lagopus*), gray wolves (*Canis lupus arctos*), wolverines (*Gulo gulo*), and beaver (*Castor canadensis*), while significant nesting bird species include the Mississippi sandhill crane and yellow-billed loon.

9.1.1.1.2. National Wildlife Refuges

There currently are two NWRs located adjacent to the Beaufort Sea and Chukchi Sea Planning Areas (**Figure C-78** and **Table C-38**) (USDOI, USFWS, 2015).

The Arctic NWR is located in northeastern Alaska in the Alaska North Slope Region bordering Canada and encompasses an area of 78,051 km^2 (30,136 mi^2). The refuge is the largest in Alaska and supports 42 fish species, 37 land mammals, eight marine mammals, and >200 migratory and resident bird species. The Arctic NWR contains five different ecological regions: lagoons, beaches and salt marshes in coastal marine areas; coastal plain tundra; alpine tundra; forest-tundra transition; and boreal forest. The Alaska National Interest Lands Conservation Act (1980) established the Arctic NWR. In section 1002 of that act, Congress set aside 607,028 ha (1.5 million ac) of coastal plain (“1002 area”) for further study and possible oil development.

The Chukchi Sea Unit of the Alaska Maritime NWR extends from Icy Cape to just north of Cape Prince of Wales in the Bering Strait and includes more mainland and barrier island acreage than the other units of the NWR. The habitats within the unit include rocky sea cliffs, lagoons and low-lying barrier islands and are important for marine birds.

9.1.1.1.3. National Estuarine Research Reserves

There are no estuaries within the Beaufort Sea and Chukchi Sea Planning Areas that are within the NERR System.

9.1.1.1.4. National Estuary Program

There are no estuaries within the Beaufort Sea and Chukchi Sea Planning Areas that are in the NEP.

9.1.1.1.5. Other Areas of Special Concern

There are no HCAs in or adjacent to the Beaufort Sea and Chukchi Sea Planning Areas. There are multiple Canadian parks, including Ivvavik National Park, Herschel Island Territorial Park, and Kendall

Island Bird Sanctuary, that border the Beaufort Sea Planning Area, and these could be impacted by accidental oil spills.

9.1.2. Cook Inlet Planning Area

The Cook Inlet Program Area includes only the northern portion of the Cook Inlet OCS Planning Area (Figure 2.1-1 in the Programmatic EIS). Cook Inlet includes land designated by the Alaska National Interest Lands Conservations Act of 1980 as units of the National Park System, NWR, Wild and Scenic Rivers, National Wilderness Preservation, and National Forest Systems. The following section describes lands managed by the NPS, USFWS, and USFS, and describes MPAs, NERRs, NEP areas, MUAs, and NOAA-designated Habitat Conservation Areas (HCAs) that could be impacted by oil and gas activities or an associated spill.

9.1.2.1. Marine Protected Areas

There are 61 MPAs in the vicinity of Cook Inlet including the Gulf of Alaska and the Aleutian Archipelago. Three of the MPAs are National System members, while 58 are eligible but not currently members. Two units of the Alaska Maritime NWR (the Alaska Peninsula and Gulf of Alaska units) (**Figure C-79** and **Table C-39**) and Glacier Bay National Park are the system members. Glacier Bay National Park is more than 805 km (500 mi) from the Program Area and is not expected to be affected by OCS oil and gas activities.

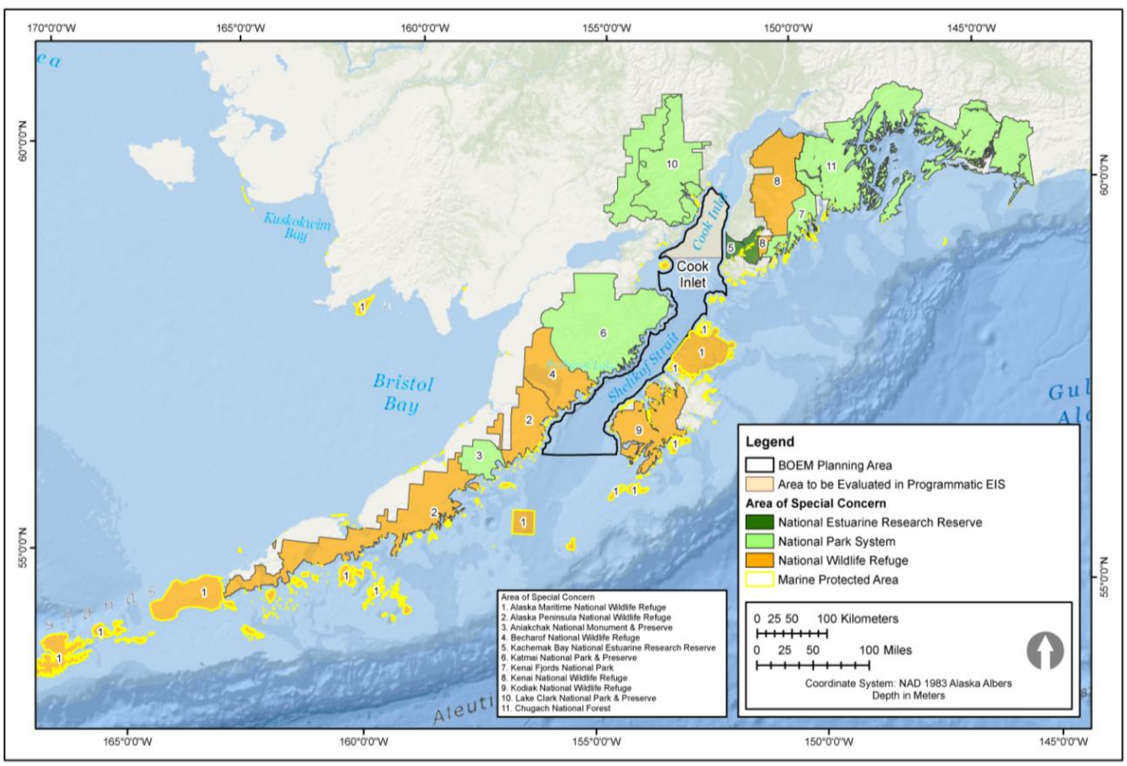


Figure C-79. Areas of Special Concern in and Adjacent to the Cook Inlet Program Area.

Table C-39. Areas of Special Concern in and Adjacent to the Cook Inlet Program Area.

No.	Name	Type	NSMPA	Fed/State	Region	Planning Area	State	EIA
1	Alaska Maritime NWR	NWR	Y	Fed	Alaska	Cook Inlet	AK	None
2	Alaska Peninsula NWR	NWR	Y	Fed	Alaska	Cook Inlet	AK	None
3	Aniakchak National Monument and Preserve	NPS	N	Fed	Alaska	Cook Inlet	AK	None
4	Becharof NWR	NWR	N	Fed	Alaska	Cook Inlet	AK	None
5	Kachemak Bay NERR	NERR	N	Fed/State	Alaska	Cook Inlet	AK	None
6	Katmai National Park and Preserve	NPS	N	Fed	Alaska	Cook Inlet	AK	None
7	Kenai Fjords National Park	NPS	N	Fed	Alaska	Cook Inlet	AK	None
8	Kenai NWR	NWR	N	Fed	Alaska	Cook Inlet	AK	None
9	Kodiak NWR	NWR	N	Fed	Alaska	Cook Inlet	AK	None
10	Lake Clark National Park and Preserve	NPS	N	Fed	Alaska	Cook Inlet	AK	None
11	Chugach National Forest	USFS	N	Fed	Alaska	Cook Inlet	AK	None

NSMPA = National System of Marine Protected Areas; EIA = Environmentally Important Areas; NWR = National Wildlife Refuge; NERR = National Estuarine Research Reserve, NPS = National Park Service; USFS = U.S. Forest Service.

Other non-member state and federal MPAs in the area are managed by the ADFG or NMFS and include HCAs and Habitat Protection Areas (HPAs) that have been closed to all bottom fishing using trawling and bottom contact gear in order to protect specific fish species and limit nearshore fishing in order to protect marine mammals feeding in the area. These include the Gulf of Alaska HCA, the Aleutian Islands Coral HPA, and the Aleutian Islands Habitat HCA. All sites listed are afforded some degree of protection based on their associated management plans. The Alaska Maritime MPA is categorized as a Natural and Cultural Heritage Conservation Area and a Sustainable Production Conservation Area. Commercial and recreational fishing is restricted. Additional state MPAs that are eligible for MPA membership contain shrimp and scallop fishing closure areas and restrictions on types of commercial fishing gear.

Although not National System MPAs, there are 43 state and federal MPAs present in the Alaskan/Fjordland Pacific Region (USDOC, NOAA, 2015). Other MPAs in the region are managed by the ADFG or NMFS and have been closed to all bottom fishing in order to protect specific species or have limited nearshore fishing to protect feeding marine mammals such as the Steller sea lion.

9.1.2.1.1. National Park Service

Lands managed by the NPS include Parks, Monuments, Preserves, Historic Areas, and designated Wild and Scenic Rivers. There are three national parks (Katmai, Lake Clark, and Kenai Fjords) and one National Monument (Aniakchak) within or adjacent to the Cook Inlet Program Area that could be affected by OCS oil and gas activities (**Table C-40**; **Figure C-79**), including accidental spills (USDOI, NPS, 2015).

Table C-40. Description of National Parks and National Monument in Cook Inlet Region.

Name	Location	Area	Description
Katmai National Park and Preserve	Western shore of Shelikof Strait, approximately 300 km (186 mi) southwest of Anchorage and across from Kodiak Island	16,564.1 km^2 (6,395.4 mi^2)	• Established to protect the region surrounding Mount Katmai and the Valley of Ten Thousand Smokes • Important habitat for brown bears and grizzly bears, salmon, and migratory bird species
Lake Clark National Park and Preserve	Approximately 160 km (100 mi) southwest of Anchorage	16,309.0 km^2 (6,297.0 mi^2)	• Protects a variety of habitats including the junction of three mountain ranges, a coastline with rainforests, a plateau with alpine tundra, glaciers, glacial lakes, major salmon-bearing rivers, and two volcanoes, Mount Redoubt and Mount Iliamna
Kenai Fjords National Park	On the Kenai Peninsula east of Cook Inlet	2,711.3 km^2 (1,046.9 mi^2)	• Park contains the Harding icefield, with almost 40 glaciers
Aniakchak National Monument and Preserve	On the Alaska Peninsula south of the Cook Inlet Planning Area (consists of region around Aniakchak Volcano)	2,433.4 km^2 (939.5 mi^2)	• Includes the Aniakchak Caldera and its Surprise Lake, source of the Aniakchak river that flows to the Pacific Ocean and provides habitat for spawning salmon

9.1.2.1.2. National Wildlife Refuges

There are currently six NWRs located adjacent to the Program Area in Cook Inlet (**Tables C-39** and **C-41**; **Figure C-79**) (USDOI, USFWS, 2015).

Table C-41. Description of National Wildlife Refuges in Cook Inlet Region.

Name	Location	Area	Description
Kenai NWR	Kenai Peninsula on the eastern side of Cook Inlet	7,770 km^2 (3,000 mi^2)	• Habitats include icefields, glaciers, mountain tundra, northern boreal forest, lakes and wetlands, and rivers • Provides important habitat for moose and other large mammals including Dall sheep, brown and black bears, and caribou, and migratory birds
Kodiak NWR	Kodiak Archipelago	8,055 km^2 (3,111 mi^2)	• Habitats include fjords, glacial valleys, and mountainous terrain; >100 salmon-bearing streams, numerous lakes, riparian wetlands, grasslands, shrub lands, spruce forest, tundra, and alpine meadows • Known for its population of Kodiak brown bears • Supports a large number of breeding pairs of bald eagles • Provides essential migration and breeding habitat for another 250 species of fish, birds, and mammals
Becharof NWR	Aleutian range of the Alaska Peninsula	4,856 km^2 (1,875 mi^2)	• Habitats including mountains, broad valleys and fjords, tundra and glacially formed lakes, as well as a volcano • Becharof Lake is an important nursery for sockeye salmon • Supports moose, caribou, bears, and migratory birds
Alaska Peninsula NWR	Southern Alaska along the southern coast of the Alaska Peninsula	14,421 km^2 (5,568 mi^2)	• Habitats includes mountains, active volcanoes, broad valleys, fjords, tundra and glacially formed lakes, wetlands, coastal lowlands, and sandy beaches • Established to conserve Alaska Peninsula brown bears, caribou, moose, marine mammals, shorebirds, other migratory birds and fish

Table C-41. Description of National Wildlife Refuges in Cook Inlet Region. (Continued.)

Name	Location	Area	Description
Izembek NWR	Alaska, Cook Inlet region	1,270 km^2 (490 mi^2)	• Smallest refuge in Alaska; most is designated wilderness • Contains a variety of fish and wildlife species including: five species of salmon, wolf, fox, and wolverine, large mammals such as caribou, moose, and brown bears, shorebirds, seabirds, waterfowl, and marine mammals including harbor seals, Steller's sea lions, sea otters, killer whales, gray whales, and minke whales • Contains Izembek Lagoon which supports one of the world's largest eelgrass beds • American Bird Conservancy designated the Izembek Refuge a Globally IBAs in 2001
Alaska Maritime NWR	Alaska, Cook Inlet region	>20,000 km^2 (7,722 mi^2)	• Established to conserve marine mammals, seabirds, and other migratory birds • Contains >2,500 islands, islets, spires, rocks, reefs, waters and headlands • Includes a variety of habitats including mountains, rivers, lakes, volcanoes, and fjords • Supports nesting habitat for an estimated 40 million seabirds • Divided into five regional units (Alaska Peninsula Unit, Aleutian Island Unit, Bering Sea Unit, Chukchi Sea Unit, and Gulf of Alaska Unit) for management purposes

9.1.2.1.3. National Estuarine Research Reserves

There is one NERR in or near the Cook Inlet Program Area: the Kachemak Bay, Alaska reserve (USDOC, NOAA-NERR, 2015) (**Figure C-79**; **Table C-39**).

Kachemak Bay, Alaska is located in Cook Inlet on the southern end of the Kenai Peninsula and encompasses an area of 1,497.3 km^2 (578.1 mi^2). The reserve contains a variety of marine and estuarine habitats, including mudflats, rocky shore, beaches, open water, and submerged aquatic vegetation, and supports large concentrations of marine mammals, including whales, porpoises, Steller sea lions, seals, and sea otters. The habitats within the NERR also support fish, including all five species of Pacific salmon, halibut, herring, tanner, Dungeness and king crabs, and several species of clams.

9.1.2.1.4. National Estuary Program

There currently are no Cook Inlet estuaries within the NEP.

9.1.2.1.5. Other Areas of Special Concern

Coastal lands managed by the USFS are at risk from potential impacts of OCS oil and gas activities, and there is one coastal national forest in the vicinity of the Cook Inlet Program Area: Chugach National Forest (USDA, USFS, 2015) (**Figure C-79**).

The closest national forest to the Cook Inlet Program Area, Chugach National Forest, covers portions of Prince William Sound, the Kenai Peninsula, and the Copper River Delta, encompassing 27,958 km^2 (10,794.6 mi^2). The area includes extensive shorelines, glaciers, forests, and rivers supporting numerous bird, mammal, and marine species. It provides shorebird habitat and supports a large bald eagle population. The Chugach Forest Management Plan identifies lands that are open or closed to oil and gas leasing by zoned areas. Currently, the plan provides for oil and gas exploration and development in the Katalla area, but the plan is undergoing revisions (USDA, USFS, 2015).

There are multiple state parks and state recreation areas near the Cook Inlet Planning Area, many of which border Cook Inlet or are located in areas that could be contacted by accidental oil spills. Such areas include Captain Cook State Recreation Area, Clam Gulch State Recreation Area, Chugach State Park, Kachemak Bay State Park and State Wilderness Park, and Ninilchik State Recreation Area.

9.2. GULF OF MEXICO PROGRAM AREA

Although the Gulf of Mexico Program Area only encompasses the Western Planning Area and most of the Central Planning Area (Figure 2.1-2 in the Programmatic EIS), the remaining portion of the Central Planning Area and all of the Eastern Planning Area have been included in the discussion because anticipated OCS activities could affect these regions.

9.2.1. Coastal Areas of Special Concern

9.2.1.1. Marine Protected Areas

There are 366 MPAs within the Gulf of Mexico, 37 are members of the National System, 165 are eligible but are not currently members, and 164 are not eligible; these estimates include a portion of southeastern Florida. Many of the MPAs in the Western and Central Planning Areas are NWRs managed by the USFWS (**Section 9.2.1.1.2**). Other MPAs include an NMS (Flower Garden Banks), an NERR (Rookery Bay), and a national park(Jean Lafitte National Historical Park and Preserve). The majority of MPAs within the Eastern Planning Area are shallow water and coastal, with the exception of Dry Tortugas National Park. The National System members in the Eastern Planning Area include national parks (Biscayne, Dry Tortugas, and Everglades), NWRs (Crocodile Lake, Great White Heron, Key West, National Key Deer, Rookery Bay, and Ten Thousand Islands), and the Florida Keys NMS (FKNMS). MPAs that are not members of the National System include state parks, special wildlife areas where restrictions protect target fish and wildlife (e.g., Florida manatee) and fishing closure MPAs (HAPCs) managed by NMFS where there are restrictions on fishing gear that can harm bottom habitat or select species.

9.2.1.1.1. National Park System (National Seashores)

There are four coastal national parks near the boundary of the Planning Areas that are administered by the NPS (USDOI, NPS, 2015). NPS lands along the coast or in coastal areas near the Gulf of Mexico Program Area include the Padre Island National Seashore (PINS) and the Gulf Islands National Seashore (**Table C-42**; **Figure C-80**). Two coastal national parks beyond the Gulf of Mexico Program Area, but near the Eastern Planning Area include the Dry Tortugas National Park and the Everglades National Park (**Table C-42**; **Figure C-80**).

Table C-42. Areas of Special Concern in and along the Western, Central, and Eastern Planning Areas of the Gulf of Mexico.

No.	Name	Type	NSMPA	Fed/State	Region	Planning Area	State	EIA
1	Anahuac NWR	NWR	Y	Fed	GOM	Western	TX	None
2	Apalachicola Bay Reserve	NERR	N	Fed/State	GOM	Eastern	FL	None
3	Aransas NWR	NWR	Y	Fed	GOM	Western	TX	None
4	Barataria-Terrebonne Estuarine Complex	NEP	N	Fed	GOM	Central	LA	None
5	Bayou Sauvage NWR	NWR	N	Fed	GOM	Central	LA	None
6	Big Boggy NWR	NWR	Y	Fed	GOM	Western	TX	None
7	Big Branch Marsh NWR	NWR	Y	Fed	GOM	Central	LA	None

Table C-42. Areas of Special Concern in and along the Western, Central, and Eastern Planning Areas of the Gulf of Mexico (Continued).

No.	Name	Type	NSMPA	Fed/State	Region	Planning Area	State	EIA
8	Bon Secour NWR	NWR	Y	Fed	GOM	Central	AL	None
9	Brazoria NWR	NWR	Y	Fed	GOM	Western	TX	None
10	Breton NWR	NWR	Y	Fed	GOM	Central	LA	None
11	Cedar Key NWR	NWR	Y	Fed	GOM	Eastern	FL	None
12	Charlotte Harbor	NEP	N	Fed	GOM	Eastern	FL	None
13	Chassahowitzka NWR	NWR	Y	Fed	GOM	Eastern	FL	None
14	Coastal Bend Bays and Estuaries	NEP	N	Fed	GOM	Western	TX	None
15	Crystal River NWR	NWR	Y	Fed	GOM	Eastern	FL	None
16	Delta NWR	NWR	Y	Fed	GOM	Central	LA	None
17	DeSoto Canyon Closed Area	NMFS	Y	Fed	GOM	Eastern/ Central	LA	None
18	Dry Tortugas National Monument	NPS	Y	Fed	GOM	Eastern	FL	None
19	East Hump MPA	MPA	N	Fed	GOM	Eastern	FL	None
20	Egmont NWR	NWR	N	Fed	GOM	Eastern	FL	None
21	Everglades National Park	NPS	Y	Fed	GOM	None	FL	None
22	Florida Keys NMS	NMS	Y	Fed/State	GOM	Eastern	FL	None
23	Florida Middle Grounds	HAPC	N	Fed	GOM	Eastern	FL	None
24	Flower Garden NMS	NMS	Y	Fed	GOM	Western	TX	Topo
25	Galveston Bay	NEP	N	Fed	GOM	Western	TX	None
26	Grand Bay NERR	NERR	N	Fed/State	GOM	Central	AL	None
27	Grand Bay NWR	NWR	Y	Fed	GOM	Central	AL/MS	None
28	Great White Heron NWR	NWR	Y	Fed	GOM	Eastern	FL	None
29	Gulf Islands NS	NPS	N	Fed	GOM	Central	MS/FL	None
30	Island Bay NWR	NWR		Fed	GOM	Eastern	FL	None
31	J.N. Ding Darling NWR	NWR	Y	Fed	GOM	Eastern	FL	None
32	Jean Lafitte National Historical Park and Preserve, Barataria Preserve	NPS	Y	Fed	GOM	Central	LA	None
33	Key West NWR	NWR	Y	Fed	GOM	Eastern	FL	None
34	Laguna Atascosa NWR	NWR	N	Fed	GOM	Western	TX	None
35	Lower Rio Grande Valley NWR	NWR	N	Fed	GOM	Western	TX	None
36	Lower Suwannee NWR	NWR	Y	Fed	GOM	Eastern	FL	None
37	Matlacha Pass NWR	NWR	Y	Fed	GOM	Eastern	FL	None
38	McFaddin NWR	NWR	N	Fed	GOM	Western	TX	None
39	McGrail Bank	HAPC	N	Fed	GOM	Western	TX	Topo
40	Mission-Aransas NERR	NERR	N	Fed/State	GOM	Eastern	TX	None
41	Mobile Bay	NEP	N	Fed	GOM	Central	AL	None
42	National Key Deer Refuge	NWR	Y	Fed	GOM	Eastern	FL	None
43	Padre Island NS	NPS	Y	Fed	GOM	Western	TX	None
44	Passage Key NWR	NWR	N	Fed	GOM	Eastern	FL	None
45	Pine Island NWR	NWR	Y	Fed	GOM	Eastern	FL	None
46	Pinellas NWR	NWR	Y	Fed	GOM	Eastern	FL	None
47	Pulley Ridge	HAPC	N	Fed	GOM	Eastern	FL	None
48	Reef Fish Stressed Area	NMFS	N	Fed	GOM	Western	TX	None
49	Rookery Bay NERR	NERR	Y	Fed/State	GOM	Eastern	FL	None

Table C-42. Areas of Special Concern in and along the Western, Central, and Eastern Planning Areas of the Gulf of Mexico (Continued).

No.	Name	Type	NSMPA	Fed/State	Region	Planning Area	State	EIA
50	Sabine NWR	NWR	Y	Fed	GOM	Central	LA	None
51	San Bernard NWR	NWR	Y	Fed	GOM	Western	TX	None
52	Sarasota Bay	NEP	N	Fed	GOM	Eastern	FL	None
53	Shell Keys NWR	NWR	Y	Fed	GOM	Central	LA	None
54	St. Marks NWR	NWR	Y	Fed	GOM	Eastern	FL	None
55	St. Vincent NWR	NWR	Y	Fed	GOM	Eastern	FL	None
56	Steamboat Lumps	NMFS	N	Fed	GOM	Eastern	FL	None
57	Stetson Bank HAPC	HAPC	N	Fed	GOM	Western	FL	Topo
58	Tampa Bay	NEP	N	Fed	GOM	Eastern	FL	None
59	Ten Thousand Islands NWR	NWR	Y	Fed	GOM	Eastern	FL	None
60	Texas Point NWR	NWR	N	Fed	GOM	Western	TX	None
61	Tortugas Marine Reserve	NMFS	N	Fed	GOM	Eastern	FL	None
62	Weeks Bay NERR	NERR	N	Fed/State	GOM	Central	AL	None
63	West and East Flower Garden Banks	HAPC	N	Fed	GOM	Western	TX	Topo

NSMPA = National System of Marine Protected Areas; EIA = Environmentally Important Areas; NWR = National Wildlife Refuge; GOM = Gulf of Mexico; NERR = National Estuarine Research Reserve; NEP = National Estuarine Program; MPA = Marine Protected Area; NPS = National Park Service; PEIS = Programmatic Environmental Impact Statement; NMS = National Marine Sanctuary; NS = National Seashore; HAPC = Habitat of Particular Concern; NMFS = National Marine Fisheries Service; Topo = topographic feature.

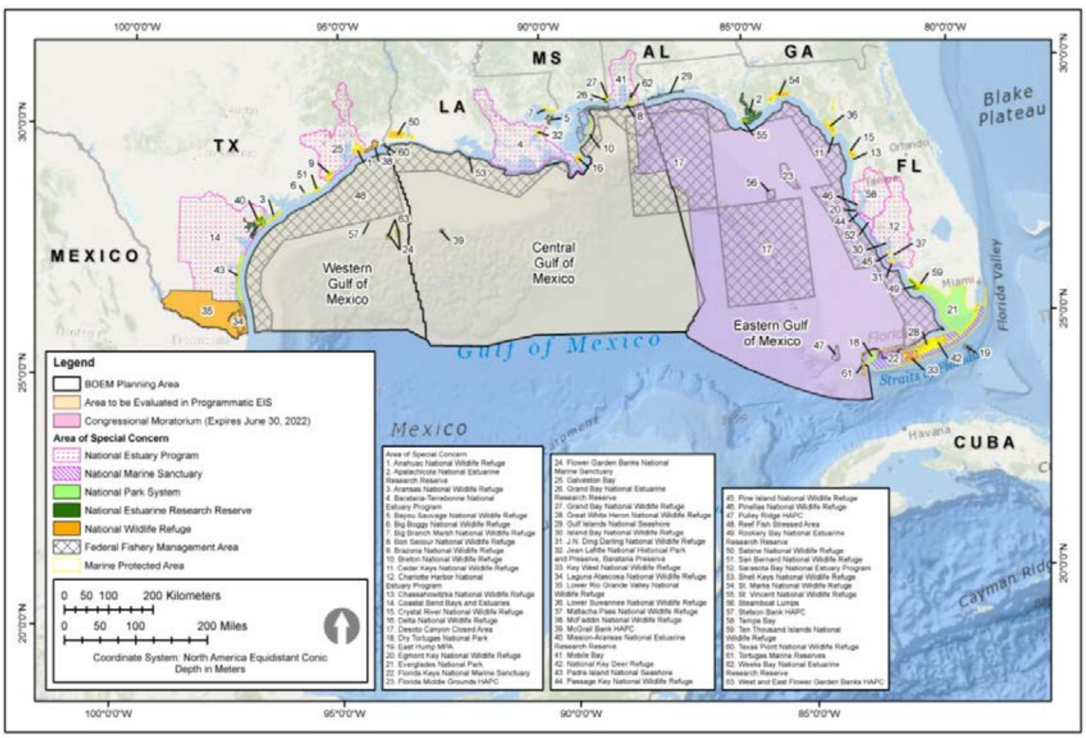


Figure C-80. Areas of Special Concern in and along the Western, Central, and Eastern Planning Areas of the Gulf of Mexico.

PINS lies along the Gulf Coast of Texas and stretches 180 km (113 mi), making it the longest barrier island in the U.S. Padre Island separates the Gulf of Mexico from the Laguna Madre, one of only a few hypersaline lagoons in the world. The park encompasses approximately 529 km^2 (204 mi^2) and is located adjacent to the Western Planning Area.

The Gulf Islands National Seashore spreads across two island chains off the coast of Mississippi and the Florida Panhandle. The Gulf Islands consist of seven barrier islands, five in Mississippi and two in Florida, making it the nation's largest national seashore, spanning more than 240 km (150 mi). The park encompasses 526 km^2 (203 mi^2) of barrier island and coastal water and is located adjacent to the shoreward portion of the Central Planning Area. The Gulf Islands National Seashore is listed as a National Watchable Wildlife Area. The Seashore's diverse habitats provide resting, feeding and nesting areas for a variety of wildlife, including birds and sea turtles. Additionally, the area has the best night skies and photic environment in the region, providing important nocturnal habitat, wilderness, and opportunities for sky viewing.

The Dry Tortugas National Monument is located almost 113 km (70 mi) west of Key West. The 261.4-km^2 (101-mi^2) park is mostly open water with seven small islands. Accessible only by boat or seaplane, the park is known the world over as the home of magnificent Fort Jefferson, picturesque blue waters, superlative coral reefs and marine life, and the vast assortment of birds that frequent the area.

The Everglades National Park encompasses nearly 6,216 km^2 (2,400 mi^2) and includes the southern portion of mainland Florida, Florida Bay, and portions of the upper Florida Keys. The park contains approximately 2,280 km^2 (880 mi^2) of marine habitat including open water, shallow waters, and mangrove-fringed shorelines and islands.

9.2.1.1.2. National Wildlife Refuges

The NWR system is a network of U.S. lands and waters managed by the USFWS specifically for the enhancement of wildlife. There are currently 30 NWRs located adjacent to the Gulf of Mexico Program Area (USDOI, USFWS, 2015) (**Figure C-80**).

All terrestrial and aquatic resources within the NWR system are managed with the goals of conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats for the benefit of present and future generations of U.S. citizens. Management approaches and conservation methods differ among NWRs but typically include managing and rehabilitating wildlife habitat, controlling invasive species, and assisting in the recovery of rare wildlife species (USDOI, USFWS, 2002).

Western Planning Area

Anahuac NWR borders Galveston Bay in southeast Texas and comprises 331.3 km^2 (127.9 mi^2) of coastal marsh and prairie. The NWR is meant to protect and manage coastal marsh for migrating, wintering, and breeding waterfowl, shorebirds, and waterbirds, and to provide strategic and crucial nesting areas for the neotropical songbirds migrating across the Gulf of Mexico (USDOI, USFWS, 2012a).

Aransas NWR encompasses 471.3 km^2 (182.0 mi^2) and includes Matagorda Island, a significant natural area, along the Texas coast. Matagorda Island encompasses 22,939 ha (56,683 ac) and stretches 61 km (38 mi) long, varying from 1.2 to 7.2 km (0.75 to 4.5 mi) wide. Approximately 30,000 of those acres are uplands and the remaining 26,000 ac are salt marsh, tidal flats, and beaches. Matagorda's orientation is northeast-southwest, with the Gulf of Mexico on one side and Espiritu Santo Bay on the other (USDOI, USFWS, 2013a).

Big Boggy NWR is on East Matagorda Bay just south of Lake Austin and 33.8 km (21 mi) south of Bay City in southern Matagorda County, Texas. The NWR conserves key coastal wetlands for neotropical birds and shorebirds migrating in spring and fall as well as for wintering waterfowl. The NWR serves as a salt marsh sanctuary and was designated an Internationally Significant Shorebird Site by the WHSRN (WHSRN, 2015). Within the NWR, Dressing Point Island is one of the most prominent bird rookeries on the Texas coast, providing breeding ground for roseate spoonbill (*Platalea ajaja*), white ibis (*Eudocimus albus*), snowy egret (*Egretta thula*), reddish egret (*Egretta rufescens*), and eastern brown pelican (*Pelecanus occidentalis*). The NWR includes 18.3 km^2 (7.1 mi^2) of salt marsh and uplands.

Brazoria NWR encompasses 179.7 km^2 (69.4 mi^2) along the coast of Texas, east of the towns of Angleton and Lake Jackson, and borders a bay on the intracoastal waterway. The NWR was established to provide wintering habitat for migratory waterfowl and other bird species. It serves as an end point for ducks and geese migrating south along the Central Flyway for the winter and an entry point for neotropical migratory songbirds headed north to their breeding grounds. Given its significance to waterfowl and migrating birds, Brazoria NWR was designated an Internationally Significant Shorebird Site (WHSRN, 2015).

Laguna Atascosa NWR, established in southeast Texas in 1946, encompasses an area of 930.9 km^2 (359.4 mi^2), including South Padre Island and the waters of the Bahia Grande. It provides habitat for wintering waterfowl and other migratory birds, principally redhead duck (*Aythya americana*), as well as serving as a site for endangered species conservation and shorebird management. The NWR also serves the largest U.S. population of the endangered ocelot (USDOI, USFWS, 2013c).

Lower Rio Grande Valley NWR, established in southeastern Texas in 1979, encompasses an area of 12,129.4 km^2 (4,683.2 mi^2) and is a unique region where four climates (temperate, desert, coastal, and subtropical) converge, resulting in a great diversity of plants and wildlife. The NWR was established to protect biodiversity from overdevelopment as a result of agricultural expansion (USDOI, USFWS, 2013d). The refuge provides habitat to 18 federally listed threatened and endangered species.

McFadden NWR is a 238.2 km^2 (92.0 mi^2) refuge that includes the largest remaining freshwater marsh on the Texas coast. The McFadden NWR is situated on the upper Gulf Coast near the Louisiana border and provides important feeding and resting habitat for migrating and wintering populations of waterfowl as well as other wildlife.

San Bernard NWR, established in 1969 near Freeport, Texas, encompasses an area of 135.6 km^2 (52.4 mi^2) and consists of coastal habitats that include beaches, dunes, estuaries, and salt marshes. Freshwater marsh and bottomland hardwood forest habitats of the Brazos and San Bernard river basins are found further inland. The refuge supports a large diversity of coastal wildlife, including 320 species of birds, 95 species of reptiles and amphibians, and 130 species of butterflies and dragonflies (USDOI, USFWS, 2013e).

Texas Point NWR is located on the upper Texas coast near the Louisiana border, and consists of 36.3 km^2 (14.0 mi^2) saline to brackish marsh, consisting of tidal flats, shallow freshwater lakes and ponds, and a marsh strongly influenced by the daily tides. Texas Point NWR has been designated by the American Bird Conservancy as a globally IBA. The habitats within this NWR provide important shallow water feeding; breeding and nesting habitat utilized by killdeer, black-necked stilt, and willet; habitat for hermit crab and juvenile flounder; and nurseries for juvenile fish.

Central Planning Area

Bayou Sauvage NWR is a marsh area adjacent to Lakes Pontchartrain and Borgne in Louisiana. Bayou Sauvage is 98.3 km^2 (38.0 mi^2) and contains a wide variety of wildlife habitat, including bottomland hardwoods, freshwater and brackish marshes, lagoons, canals, borrow pits, and natural bayous. Bayou Sauvage is an important stopover along the Mississippi Flyway and supports the needs of approximately 340 bird species throughout the year. Shorebirds are present year round and the refuge supports a large wading bird rookery.

Breton NWR is the second oldest wildlife refuge, established in 1904. The refuge encompasses an area of 30.5 km^2 (11.8 mi^2) and consists of barrier islands, including the Chandeleurs, located in the Gulf of Mexico off the southeast coast of Louisiana. According to the National Wildlife Service (NWS), the refuge has one of the larger nesting colonies of royal tern and sandwich tern. The refuge also serves as an important area for reddish egret and provides nesting habitat for various other colonial seabirds. The refuge has a large non-breeding concentration of magnificent frigatebirds, a large winter concentration of redhead duck, and a smaller number of canvasback and scaup. It also serves large nesting colonies of several thousand Eastern brown pelicans and provides wintering migration habitat for piping plover and other shorebirds (USDOI, USFWS, n.d.-a).

Delta NWR, established in 1935, encompasses 204.8 km^2 (79.1 mi^2) just south of Venice, Louisiana. It is part of the currently active Mississippi River Delta, and is composed of marsh habitat. The NWR was established as a bird sanctuary. It provides wintering habitat and sanctuary for waterfowl and other migratory birds (USDOI, USFWS, n.d.-c).

Shell Keys NWR was established in 1907, and consists of 0.02 km^2 (0.007 mi^2) of dynamic shell fragment islets located within the south Marsh Island west of Greenwich, Louisiana. The boundary of the refuge has been interpreted to be those areas in this vicinity that are above mean high tide. This region is an important area for wading birds and shorebirds. Recent hurricanes and storms have eroded the island to such an extent that no nesting has occurred since 1992 (USDOI, USFWS, 2008).

Grand Bay NWR encompasses 41.2 km^2 (15.9 mi^2) in Mobile County, Alabama and Jackson County, Mississippi. The NWR partially overlays the Grand Bay NERR and was established to protect one of the largest remaining expanses of Gulf Coast wet pine savanna habitat. It also includes maritime forest, tidal and non-tidal wetlands, salt marshes, salt pans, bays and bayous.

Bon Secour NWR is made up of five areas located in Baldwin and Mobile Counties, Alabama and encompasses 28.3 km^2 (10.9 mi^2). Bon Secour is a coastal dune ecosystem providing habitat for migratory birds, nesting sea turtles, and the endangered Alabama beach mouse (*Peromyscus polionotus ammobates*). More than 370 species of birds have been identified at the refuge during migratory seasons.

Eastern Planning Area

Cedar Keys NWR, established in 1929, encompasses 3.3 km^2 (1.3 mi^2) in coastal Levy County, Florida. The refuge comprises 12 offshore islands, around the town of Cedar Key, ranging in size from a few ac to 120 ac. Four of the offshore islands are designated as WAs. The refuge contains one of the largest colonial bird nesting sites in northern Florida, with a wide variety of birds nesting on the island (USDOI, USFWS, n.d.-b).

Chassahowitzka NWR, established in 1941, consists of >12,545 ha (31,000 ac) of saltwater bays, estuaries, and brackish marshes at the mouth of the Chassahowitzka River, Florida, encompassing a total area of 148.7 km^2 (57.4 mi^2). According to the NWS, the NWR was established primarily to protect waterfowl habitat and is home to >250 species of birds, >50 species of reptiles and amphibians, and at least 25 different species of mammals (USDOI, USFWS, 2013b).

Crystal River NWR, established in 1983, was specifically created for protection of the endangered Florida manatee, a subspecies of the West Indian manatee. The refuge protects important wintering habitat for manatees in Kings Bay, Florida, including King Spring and Three Sisters Springs (USDOI, USFWS, 2014a). This refuge encompasses an area of 33.8 km^2 (13.1 mi^2).

Egmont Key NWR encompasses 1.3 km^2 (0.51 mi^2) at the mouth of Tampa Bay. The NWR protects a diverse community of animals and plants, many of which are threatened or endangered such as the gopher tortoise and least tern.

Great White Heron NWR, established in 1938, is located in the lower Florida Keys and consists of approximately 81,000 ha (200,000 ac) of open water and islands that are north of the primary Keys from Marathon Key to Key West. The islands cover approximately 7,600 ac and consist primarily of mangroves. Some of the larger islands support pine rockland and tropical hardwood hammock habitats. The refuge provides important habitat for great white herons, migratory birds, and other wildlife (USDOI, USFWS, n.d.-d). The NWR encompasses 837.8 km^2 (323.5 mi^2).

J.N. Ding Darling NWR, established in 1945, encompasses 32.7 km^2 (12.6 mi^2) on Sanibel Island, in Lee County, Florida. The refuge is composed of several habitat types: estuarine habitat comprising open water, seagrass beds, mud flats, and mangrove islands; and interior freshwater habitats comprising open water ponds, *Spartina* swales, and West Indian hardwood hammocks and ridges. Two brackish water impoundments totaling 324 ha (800 ac) are used extensively by wading birds and other water birds (USDOI, USFWS, n.d.-e).

Key West NWR, established in 1908, encompasses 850.1 km^2 (328.2 mi^2) and is almost entirely within the marine environment. The refuge consists of coral reef and seagrass communities as well as mangrove islands with limited sandy beach and dune habitat and regions of large sand flats. There are some areas with salt marsh and coastal berm hammocks. The refuge supports critical nesting, roosting, wading, and loafing habitat to more than 250 bird species, particularly wading birds (USDOI, USFWS, n.d.-f).

Lower Suwannee NWR, established in 1979 in Dixie and Levy Counties, Florida, consists of 339 km^2 (131 mi^2) of land located along the lower reaches of the Suwanee River, beginning at Yellow Jacket, Florida and continuing for 20 mi until the Suwanee River enters the Gulf of Mexico. From the mouth of the river, the refuge extends northward along the coast for 10 mi. The refuge consists of 14,569 ha (36,000 ac) of wetlands and 6,475 ha (16,000 ac) of uplands, providing important habitat for wading birds, shorebirds, migratory songbirds, and raptors (USDOI, USFWS, n.d.-g).

Matlacha Pass NWR is located within the Matlacha Pass in Charlotte Harbor Estuary, in Lee County, Florida. The refuge includes 23 islands encompassing approximately 0.8 km^2 (2.0 mi^2) that have upland sand ridges and mangrove habitats providing nesting locations for osprey, black skimmer (*Rynchops niger*), and least tern.

National Key Deer Refuge, established in 1957 in Monroe County, Florida, consists of 557.1 km^2 (215.1 mi^2) of upland forest, shrub wetland, and wetland marsh habitat. The refuge encompasses the truncated historical range of the endangered Key deer (*Odocoileus virginianus clavium*), including critical habitat. It also serves as home to tropical hardwood hammock habitat and 22 federally listed endangered and threatened species of plants and animals, 5 of which are unique to the NWR (USDOI, USFWS, n.d.-h).

Passage Key NWR is a small (0.12 km^2 [0.05 mi^2]) barrier island located in Manatee County, Florida approximately 2.4 km (1.5 mi) south of Egmont Key. The island was originally mangroves, but the mangroves were destroyed by a hurricane in 1920. However, the NWR still hosts the largest royal tern and sandwich tern colonies in Florida.

Pinellas NWR encompasses 1.59 km^2 (0.62 mi^2) offshore St. Petersburg, Florida and was established as a breeding ground for colonial bird species. Herons, cormorants, egrets, endangered eastern brown pelicans, and many additional species use this refuge for nesting. Tarpon Key, one of the islands in the NWR, hosts the largest eastern brown pelican rookery in Florida.

St. Marks NWR was established in 1931 and encompasses 446.9 km^2 (172.6 mi^2) along the Florida Panhandle. The refuge includes coastal marshes, islands, and tidal creeks and estuaries of seven northern Florida rivers, and is home to a diverse community of plant and animal life. The refuge has more than 6,880 ha (17,000 ac) protected under the Federal Wilderness Act (USDOI, USFWS, 2015).

St. Vincent NWR was established in 1968 in Franklin and Gulf Counties, Florida. The refuge encompasses 49.1 km^2 (19.0 mi^2) on a coastal barrier island consisting of open water, wetlands, forest, shrub, and sand dune habitat. The refuge serves as a stopover for migratory birds, red wolf propagation, nesting raptors, and nesting loggerhead sea turtles (USDOI, USFWS, n.d.-i).

Ten Thousand Islands NWR was established in 1996 in Collier County, Florida. The refuge covers 140.4 km^2 (54.2 mi^2) of diverse wetland habitat, supported by freshwater flow from the Fakahatchee Strand and Picayune Strand watersheds. The refuge provides habitat for large concentrations of wading birds, shorebirds, waterfowl and other water birds. Ten percent of Florida's manatee population utilizes the refuge and adjacent waters (USDOI, USFWS, n.d.-j).

9.2.1.1.3. National Estuarine Research Reserves

The NERR System is a partnership between NOAA and coastal states protecting >526,000 ha (1.3 million ac) of coastal and estuarine areas in a network of 28 reserves located in 22 states and Puerto Rico. The NERRs are relatively pristine estuarine areas with habitat key to long-term research, environmental monitoring, education, and stewardship that therefore are protected from significant ecological change or developmental impacts (USDOC, NOAA-NERR, 2011). The NERRs in or near the Gulf of Mexico Program Area are Mission-Aransas, Texas; Grand Bay, Mississippi; Week Bay, Alabama; Apalachicola, Florida; and Rookery Bay, Florida (**Figure C-80**) (USDOC, NOAA-NERR, 2015).

Western Planning Area

Mission-Aransas NERR along the western coast of the Gulf of Mexico, consists of a 185,708-ac contiguous complex of wetland, terrestrial, and marine environments, encompassing a total area of 748.7 km^2 (289.1 mi^2). The wetland component comprises riparian habitat as well as freshwater and salt water marshes. The open water component has bays with tidal flats, seagrass meadows, mangroves, and oyster reefs (USDOC, NOAA-NERR, 2009b). The reserve supports forage habitats for migratory bird species and for economically important fish species.

Central Planning Area

Weeks Bay NERR in coastal Alabama is located between Pascagoula, Mississippi and the Alabama state line and includes a small estuary, covering approximately 73.0 km^2 (28.2 mi^2). The reserve is composed of open shallow waters, with an average depth of <1.5 m (5 ft) and extensive vegetated wetlands. Freshwater enters from the Fish and Magnolia Rivers, and the reserve connects with Mobile Bay through a narrow opening. The Reserve's habitats support rare and endangered plant and animal species, important marine fisheries and archeological sites, and is one of the most biologically productive estuarine ecosystems in the northern Gulf of Mexico.

Grand Bay NERR encompasses >24.3 km^2 (9.4 mi^2) of tidal and forested wetlands within the greater Mobile Bay estuarine system along the northern Gulf of Mexico. The estuary supports several rare or endangered plant and animal species (e.g., Eastern brown pelican [*Pelecanus occidentalis*], Eastern indigo snake [*Drymarchon couperi*], and the Alabama red-bellied turtle [*Pseudemys alabamensis*]), numerous important marine fishery resources, diverse habitat types, and important archaeological sites. It contains a diverse range of habitats, including coastal bays, saltwater marshes, maritime pine forests, pine savannas, and pitcher plant bogs. It supports extensive and productive oyster reefs and seagrass habitats. In addition, the estuary serves as a nursery area for many important recreational and commercial marine species, including shrimp, blue crab, speckled trout (*Cynoscion nebulosus*), and red drum.

Eastern Planning Area

Apalachicola Bay Reserve is a lagoon and barrier island complex consisting of 99,553 ha (246,000 ac) of the Florida Panhandle approximately 121 km (75 mi) southeast of Tallahassee, and 97 km (60 mi) east of Panama City. The management area includes two barrier islands and a portion of a third island; the lower 84 km (52 mi) of the Apalachicola River and its floodplain; portions of adjoining uplands; and the Apalachicola Bay estuarine, riverine, and floodplain systems. Major estuarine habitats found within the reserve include oyster bars, submerged vegetation, tidal flats, soft sediment, marshes and open water (NERRS, 2009a). The reserve supports forage habitat for migratory bird species and for economically important fish species.

Rookery Bay NERR encompasses 388.2 km^2 (149.9 mi^2) along Florida's Gulf coast south of Naples. The reserve is a subtropical, mangrove-forested estuary consisting of approximately 445 km^2 (110,000 ac), 283 km^2 (70,000 ac) of which is open water. The remaining 40,000 ac are primarily composed of mangroves, fresh to brackish water marshes, and upland habitats, including upland hammocks and scrub. The reserve provides important habitat to more than 150 species of birds, economically important fish species, and threatened and endangered species, including the Florida panther (*Puma concolor coryi*) (NERRS, 2009c).

9.2.1.1.4. State-Designated Marine Protected Areas

Numerous state-designated coastal, nearshore, and offshore MPAs are located within and adjacent to the Western, Central, and Eastern Planning Areas that include state parks, resource conservation areas (e.g., nature preserves, artificial reefs, aquatic preserves, natural areas, and wildlife management areas), sanctuaries, water quality protection areas, and historical areas.

9.2.1.2. National Estuary Program

In 1987, an amendment to the Clean Water Act, known as the Water Quality Act (P.L. 100-4), established the National Estuary Program (NEP). The purposes of the program are to (1) identify nationally significant estuaries, (2) protect and improve their water quality, and (3) enhance their living resources. Under the administration of the USEPA, comprehensive administration plans are generated to protect and enhance the environmental resources of estuaries designated to be of national importance. A state's governor may nominate an estuary for the NEP and request a comprehensive conservation and management plan be developed. Over a 5-year period, representatives from federal, state, and interstate agencies; academic and scientific institutions; and industry and citizens groups work to define objectives for protecting the estuary, select the chief problems to be addressed in the plan, and ratify a pollution-control and resource-management strategy to meet each objective. Gulf of Mexico estuaries falling within the NEP include Coastal Bend Bays and Estuaries, Corpus Christi Bay, and Galveston Bay (adjacent to the Western Planning Area); Barataria-Terrebonne Estuarine Complex and Mobile Bay (adjacent to the Central Planning Area); and Tampa Bay, Sarasota Bay, and Charlotte Harbor (adjacent to the Eastern Planning Area) (USEPA, 2012; **Figure C-80**).

9.2.2. Marine Areas of Special Concern

9.2.2.1. National Marine Sanctuaries

Western Planning Area

There is a single NMS in the Western Planning Area, the Flower Garden Banks NMS, located in the northwestern Gulf of Mexico (**Figure C-80**). The Flower Garden Banks NMS is administered by NOAA's Office of National Marine Sanctuaries (ONMS).

The Flower Garden Banks NMS is located in the northwestern Gulf of Mexico and consists of three distinct areas: East Flower Garden Bank, West Flower Garden Bank, and Stetson Bank. The 65.86 km^2 (19.20 nmi^2) East Flower Garden Bank is located approximately 222 km (120 nmi) south-southwest of Cameron, Louisiana, and the 77.54 km^2 (22.61 nmi^2) West Flower Garden Bank is located approximately 200 km (108 nmi) southeast of Galveston, Texas. The 2.18 km^2 (0.64 nmi^2) Stetson Bank is located approximately 110 km (61 nmi) southeast of Galveston, Texas.

Structurally, Flower Garden Banks coral reefs are composed of large, closely spaced coral heads up to 3 m (10 ft) in diameter and height. The Flower Garden Banks reefs are the northernmost living coral reefs on the U.S. continental shelf. Isolated from other coral reef systems by >556 km (300 nmi), the East and West Flower Garden Banks are dominated by hard corals, supporting at least 21 species. Eight species of coral are found on Stetson Bank, where cooler water temperatures favor non-reef building corals and sponges. East Flower Garden Bank is home to the only known oceanic brine seep in Gulf of Mexico continental shelf waters. The super-saline water flowing from under the seafloor has created a concentrated brine lake and channel in which only certain bacteria are able to live. This "lake" and "river" are only approximately 25.4 cm (10 inches) deep (USDOI, BOEM, 2007).

East Flower Garden Bank is a pear-shaped dome capped by 1 km^2 (250 ac) of coral reef, termed "coral cap," that rises to within 17 m (55 ft) of the surface. West Flower Garden Bank is an oblong-shaped dome that includes 0.4 km^2 (100 ac) of coral reef area starting 18 m (59 ft) below the water surface. Brain and star corals dominate the coral caps of the Flower Garden Banks, with diameters of some coral heads exceeding 6 m (20 ft). On average, between 45 and 52 percent of the seafloor of the coral caps at Flower Garden Banks are covered by coral species to depths of 30 m (100 ft). In places, coral cover exceeds 70 percent to depths of at least 43 m (141 ft) (Hickerson et al., 2005). Interestingly, these coral caps do not contain some species commonly found elsewhere in the Caribbean, including many branching corals, sea whips, and sea fans.

Less well known is the deepwater habitat of the Flower Garden Banks that makes up >98 percent of the area within sanctuary boundaries. Habitats below recreational SCUBA limits (approximately 40 m [130 ft]) include algal-sponge zones, "honeycomb" reefs (highly eroded outcroppings), mud flats, mounds, mud volcanoes, and at least one brine seep system. Different assemblages of sea life reside in these deeper habitats, including extensive beds of coralline algae, pavements and algal nodules, colorful sea fans, sea whips, black corals, deep reef fish, batfish, searobins, basket starfish, and feather stars (USDOI, BOEM, 2012a).

Depths at Stetson Bank range from approximately 17 to 52 m (55 to 170 ft). There are more extreme temperature and turbidity fluctuations at Stetson Bank than at East and West Flower Garden Banks, and it does not support the growth of reef-forming corals. Stetson Bank has a low-diversity coral community in addition to prominent sponge fauna. The outcrops at Stetson Bank are dominated by the colonial hydrozoan fire coral (*Millepora alcicornis*) and sponges (Phylum Porifera), with cover exceeding 30 percent (Bernhardt, 2000). There are at least nine coral species at Stetson Bank, but with the exception of a large area of ten-ray star coral (*Madracis decactis*), most colonies are small and sparsely distributed (Hickerson et al., 2008).

Located in the general region of the East and West Flower Garden Banks are other reefs and banks designated as HAPCs through NMFS EFH legislation, including Sonnier Bank, McGrail Bank, Bright Bank, Geyer Bank, and Alderdice Bank. These designated deepwater habitats contain outcroppings rising up from the seafloor populated with benthic invertebrates, coralline algae, deep coral biota, and a variety of fish species. All HAPCs are protected from certain fishing operations and vessel anchoring, and are identified as areas for special consideration during individual species assessments.

More than 300 different fish species and 3 species of sea turtles (hawksbill, leatherback, and loggerhead) inhabit the Flower Garden Banks NMS. Macroalgae, crustaceans, sharks, skates, rays, many different types of benthic invertebrates, and a variety of seabirds thrive in the protected waters of the NMS (Showalter, 2003).

All of the Flower Garden Banks NMS is in the Program Area. It is worth noting that expansion of the sanctuary is proposed following several years of scientific assessment and public input. The proposed expansion is one of the top priority issues that emerged during the management plan review process, completed in 2012. The sanctuary's advisory council recommended expanding the sanctuary from 145.6 km^2 (56.2 mi^2) to 725.9 km^2 (280.3 mi^2) to include up to nine additional reefs and banks, which support essential habitat for commercial and recreational fish species (USDOC, NOAA, 2015).

Eastern Planning Area

Adjacent to the Eastern Planning Area is the FKNMS. Although well outside the boundaries of the Gulf of Mexico Program Area, it is included for discussion given its scale and sensitive resources.

The FKNMS protects 9,947 km^2 (2,900 nmi^2) of waters surrounding the Florida Keys (**Figure C-80**), from south of Miami westward to encompass the Dry Tortugas, excluding Dry Tortugas National Park. This sanctuary is administered by NOAA and is jointly managed with the State of Florida. It spans a shallow-water interface between the Gulf of Mexico and the Atlantic Ocean and is adjacent to most of the relatively shallow estuarine waters of south Florida, including those of Florida Bay and Biscayne Bay. The sanctuary surrounds >1,700 islands, which constitute most of the limestone island archipelago of the Florida Keys. This archipelago extends from the Florida peninsula south and west more than 354 km (220 mi), terminating at the islands of Dry Tortugas NP. The sanctuary contains components of five distinct physiographic regions: Florida Bay, the Southwest Continental Shelf, the Florida Reef Tract, the Florida Keys, and the Straits of Florida. These regions are environmentally and lithologically unique, and together they form the framework for the sanctuary's diverse terrestrial and aquatic habitats. The oceanic boundary of the sanctuary is the 100-m (328-ft) depth contour, beyond which the Florida Straits separate the Florida Keys from both Cuba and the Bahamas. The waters north and west of the Keys are within the eastern Gulf of Mexico. The portion of the Sanctuary within the Gulf of Mexico is important as a fisheries resource, serving as the nursery grounds for many recreationally and commercially important species of fishes and invertebrates, including groupers, snappers, pink shrimp, spiny lobster, and stone crab.

The FKNMS supports 6,000 species of marine life and contains the world's third largest barrier reef, extensive seagrass meadows, and mangrove-fringed islands. A variety of plants, invertebrates, fishes, reptiles, birds, and mammals that use or contribute to the FKNMS's resources in the Florida Keys are protected at the federal or state level. Each species is a valuable natural resource that contributes to the ecological balance of the sanctuary. Animal species at risk are dependent on the Sanctuary's diverse habitats, including mangroves, beaches (below high water mark), seagrass beds, and coral reefs. State and federally listed threatened and endangered marine and aquatic fauna include elkhorn coral, staghorn coral, pillar coral; all five species of sea turtle found in the western Atlantic (loggerhead, green, hawksbill, Kemp's ridley, and leatherback); American alligator (*Alligator mississippiensis*); American crocodile (*Crocodylus acutus*); smalltooth sawfish; roseate tern; least tern; and West Indian manatee. The sanctuary is also in the migratory range of NARW, humpback, and fin whales. The FKNMS also has historical elements such as shipwrecks and archeological treasures, including approximately 669 documented historic artificial reefs. Currently, 14 shipwrecks and two lighthouses within the sanctuary are listed in the *National Register of Historic Places*.

9.2.2.2. Deepwater Marine Protection Areas

Eastern Planning Area

The Pulley Ridge HAPC, the deepest hermatypic coral reef in the continental U.S., is located on Pulley Ridge off the southwest coast of Florida (**Figure C-80**) and encompasses an area of 344 km^2 (132.8 mi^2). Pulley Ridge is a drowned barrier island approximately 100 km (62 mi) long by 5 km (3.1 mi) wide, running parallel to the Florida peninsula northwest of the Dry Tortugas. Live corals dominated by *Agaricia* sp. occur between the 60- and 70-m (197- and 230-ft) depth contours on the reef with a diverse assemblage of shallow-water and deepwater fish species. As in the FKNMS, the Pulley Ridge HAPC falls outside of the Gulf of Mexico Program Area but is included given its scale and sensitive resources.

Due to its designation as an HAPC, some fishing activities on Pulley Ridge have been restricted, but growing concern for hermatypic corals in the area may lead to implementing future management options. The GMFMC has expressed concern that fishing operations are causing ongoing damage to the Pulley Ridge habitat and it is considering additional protective measures (USDOI, BOEM, 2014).

While there are substantial areas of cold-water coral habitat in the Gulf of Mexico, it appears to be more scattered and less extensive than such habitats in the Atlantic Ocean off the southeastern U.S. Much of the research into the cold-water coral communities of the Gulf of Mexico has involved communities on the northern continental slope. There, several studies have found coral habitat consisting of reef-building species such as the deepwater white coral (*Lophelia pertusa*) and zigzag coral (*Madrepora oculata*). The most extensive cold-water coral communities found to date in the Gulf of Mexico occur at the Viosca Knoll, located on the upper DeSoto Slope, approximately 120 km (65 nmi) south of the mouth of Mobile Bay, Alabama. The main Viosca Knoll site (the VK 826 Coral Habitat) is an isolated feature that rises 90 m (295 ft) from the surrounding seafloor, providing high relief for an array of suspension feeders including scleractinian, gorgonian, and anthipatharian corals. The VK 862 *Lophelia* and Black Coral Habitat is located approximately 40 km (25 mi) west of the VK 826 Coral Habitat.

9.2.2.3. Other Federal Fishery Management Areas

NMFS and the GMFMC have designated numerous federal fishery management areas. Other federally protected areas, with different degrees of management and protection, include reserves such as the Tortugas Ecological Reserve and the Reef Fish Stressed Area. The MPAs described in this section are not part of the national system of MPAs, but they are eligible to become members (**Figure C-80**). These areas, including the Pulley Ridge HAPC described in **Section 9.2.2.2**, have restrictions on certain types of fishing activities.

Western Planning Area

The West and East Flower Garden Banks HAPC is described in the **Section 9.2.2.1**.

Central Planning Area

McGrail Bank (formerly known as 18 Fathom Bank), mentioned in **Section 9.2.2.1**, is one of several named banks on the continental shelf in the northwestern Gulf of Mexico. Designated an HAPC, the seafloor habitat of McGrail Bank is protected from fish traps and anchoring (USDOC, NOAA, NOS, 2014). The entirety of McGrail Bank, 48 km^2 (18.5 mi^2) falls within the Gulf of Mexico Program Area. McGrail Bank is located approximately 46 km (30 mi) east-northeast of Geyer Bank, and 97 km (60 mi) east-northeast of East Flower Garden Bank. It consists of a pair of ridges separated by a valley. McGrail Bank has the shallowest crest of any of the shelf-edge banks west of the Mississippi Delta, excluding the Flower Garden Banks. The top of the bank is 46 m (151 ft) deep (USDOC, NOAA, NOS, 2014). Deeper reef habitat includes extensive coralline algae and deep coral assemblages. McGrail Bank appears to be biologically and geologically connected to Flower Garden Banks NMS. Boundaries of the Flower Garden Banks NMS may be expanded to include McGrail Bank (USDOC, NOAA, 2015).

Eastern Planning Area

The East Florida Coast Closed Area is located primarily along Florida’s Atlantic coast, but a small portion extends around the southern tip of the Florida peninsula. This area is closed to fishing gear that may indiscriminately catch non-target species such as that used in a longline fishery. This MPA is closed year round, and its management primarily focuses on alleviating impacts to select species of fish and all sea turtles (USDOC, NOAA, n.d.-a)

The Florida Middle Grounds are a complex series of carbonate hard bottom outcrops located approximately 138 km (86 mi) south of Apalachee Bay, Florida. The Florida Middle Grounds HAPC encompasses an area of 1,159.6 km^2 (447.7 mi^2), with outcrops having up to 17 m (56 ft) relief distributed over approximately 1,193 km^2 (460 mi^2).

The northernmost extent of hermatypic coral growth in the U.S. occurs on the Florida Middle Grounds (Puglise and Kelty, 2007), and fauna most closely resemble a tropical reef. Branching fire coral, elliptical star coral, and ten-ray star coral are common, as are octocorals, sea fans of the genus *Muricea*, and the giant barrel sponge (Naar et al., 2007). Other fauna include hydroids, anemones, mollusks, crustaceans, echinoderms, polychaetes, and fishes, among others (Hopkins et al., 1977; Coleman et al., 2004). The Florida Middle Grounds are not considered a true coral reef because hermatypic corals are not abundant enough to allow for the successful accretion of a carbonate reef (USDOI, BOEM, 2013).

Two marine reserves, the Madison-Swanson and Steamboat Lumps Marine Reserves, have been established to help manage gag grouper (*Mycteroperca microlepis*) populations in the Gulf of Mexico. The Madison-Swanson Marine Reserve is a 400-km^2 (155-mi^2) protected area consisting of small outcrops as well as a few higher pinnacles with up to 9 m (30 ft) of relief (USDOI, BOEM, 2013). Madison-Swanson Marine Reserve is located in waters 60 to 140 m (197 and 459 ft) deep, approximately 80 km (50 mi) south of Apalachicola, Florida. The site is home to sponges, sea fans, corals (including bush/tree corals), echinoderms, and crabs (USDOI, BOEM, 2013).

Steamboat Lumps Marine Reserve is located 161 km (100 mi) south-southwest of Cape San Blas, Florida, and approximately 32 km (20 mi) southwest of the Florida Middle Grounds. The reserve encompasses approximately 365 km^2 (138 mi^2) in 60 to 140 m (197 to 459 ft) of water, and comprises a relic reef (Hine and Locker, 2008). Fauna in the Reserve is typical of a deepwater reef, with sponges, sea fans, black corals, bush/tree corals, echinoderms, and crustaceans (USDOI, BOEM, 2013).

The Tortuga Marine (Ecological) Reserve consists of two regions totaling 518 km^2 (151 nmi^2) in area, created in 2001 at the western extent of the FKNMS. The reserve is closed to all consumptive use, including fishing and anchoring, and a portion of it is only open to permitted marine research (Jeffrey et al., 2012). The marine reserve encompasses 229.4 km^2 (88.6 mi^2) and lies adjacent to the southeast corner of the Eastern Planning Area.

Multiple Planning Areas

The Desoto Canyon Closed Area, located off the west coast of Florida, is a federal Fishery Management Zone and has been managed by NMFS since its designation in 2000. The MPA is closed year-round to all pelagic longline gear in order to protect tunas, swordfish, and other billfish and sharks (USDOC, NOAA, n.d.-a). The closed area encompasses 86,854 km^2 (33,534.5 mi^2) within the Central and Eastern Planning Areas.

9.3. ATLANTIC PROGRAM AREAS

The Mid-Atlantic Planning Area extends from the New Jersey-Delaware border to the North Carolina-South Carolina border (Figure 2.1-3 in the Programmatic EIS). Although not within the immediate Atlantic Program Area as a result of a 80-km (50-mi) coastal buffer, there are important coastal landscapes along the mid-Atlantic coast, including the Chesapeake Bay (an NERR) and four National Estuaries: Delaware Estuary, Delaware inland bays, Maryland coastal bays, and the Albemarle-Pamlico Sounds. These are discussed as potentially affected environments due to the nature of anticipated activities in these lease areas.

The South Atlantic Planning Area extends from the North Carolina-South Carolina border to the central portion of Florida's Atlantic coast (Figure 2.1-3 in the Programmatic EIS). There is a 80-km (50-mi) coastal buffer between OCS activities within the Atlantic Program Area and the Atlantic coast (Figure 2.1-3 in the Programmatic EIS). Due to the nature of oil and gas activities and the potential for spills, coastal MPAs falling within the 80-km (50-mi) buffer are included in this section's discussion of affected environments.

9.3.1. Coastal Areas of Special Concern

9.3.1.1. Marine Protected Areas

There are 534 MPAs along the Atlantic coast from Cape Cod, Massachusetts to Palm Beach, Florida; 99 are members of the National System, 234 are eligible but are not currently members, and 201 are not eligible. MPAs along the Atlantic coast include those managed by NMFS and those closed to certain types of fishing gear to reduce the impacts on select species of fish and sea turtles such as the Charleston Bump and East Florida Closed Area MPAs. Other areas have been designated to protect the snapper-grouper complex, protected deepwater wreckfish, or coldwater corals (**Section 9.3.2.1.2**). In addition, MPAs along the Atlantic Coast consist of National Seashores (**Section 9.3.1.1.1**), NWRs (**Section 9.3.1.1.2**), NERRs (**Section 9.3.1.1.3**), and NMSs (**Section 9.3.2.1.1**) (**Figure C-81**; **Table C-43**). Additional MPAs include state parks and preserves and state conservation zones that have restrictions to protect select species.

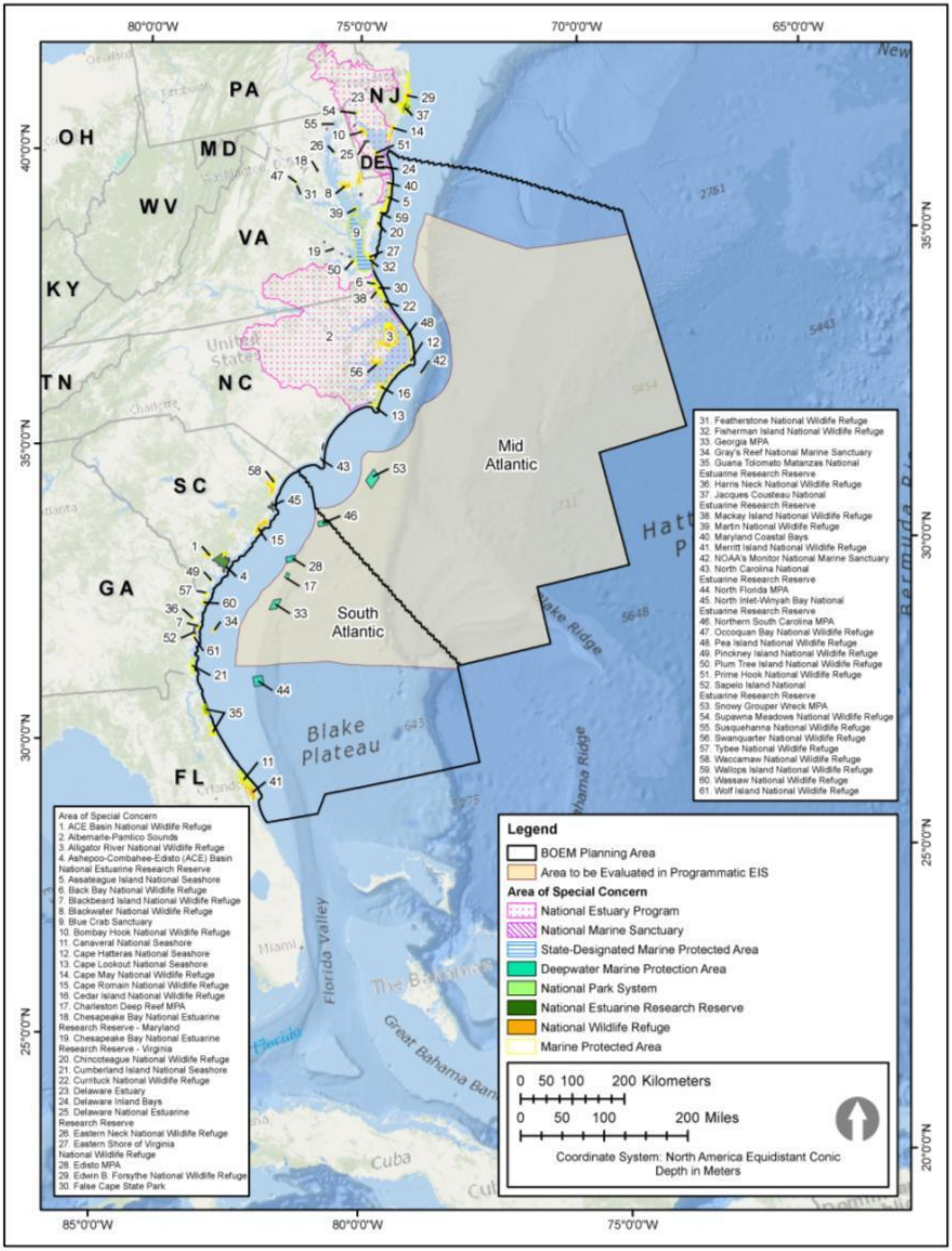


Figure C-81. Areas of Special Concern in and along the Mid- and South Atlantic Planning Areas.

Table C-43. Areas of Special Concern in and along the Mid- and South Atlantic Planning Areas.

No.	Name	Type	NSMPA	Fed/State	Region	Planning Area	State	EIA
1	ACE Basin NWR	NWR	Y	Fed	Atlantic	So-Atl	SC	None
2	Albemarle-Pamlico Sounds	NEP	N	Fed	Atlantic	Mid-Atl	NC	None
3	Alligator River NWR	NWR	Y	Fed	Atlantic	Mid-Atl	NC	None
4	Ashepoo-Combahee-Edisto (ACE) Basin NERR	NERR	N	Fed/State	Atlantic	So-Atl	SC	None
5	Assateague Island NS	NPS	Y	Fed	Atlantic	Mid-Atl	MD/VA	None
6	Back Bay NWR	NWR	N	Fed	Atlantic	Mid-Atl	VA	None
7	Blackbeard Island NWR	NWR	Y	Fed	Atlantic	So-Atl	GA	None
8	Blackwater NWR	NWR	Y	Fed	Atlantic	Mid-Atl	MD	None
9	Blue Crab Sanctuary	Sanct	Y	State	Atlantic	Mid-Atl	VA	None
10	Bombay Hook NWR	NWR	Y	Fed	Atlantic	Mid-Atl	DE	None
11	Canaveral NS	NPS	Y	Fed	Atlantic	So-Atl	FL	None
12	Cape Hatteras NS	NPS	Y	Fed	Atlantic	Mid-Atl	NC	None
13	Cape Lookout NS	NPS	Y	Fed	Atlantic	Mid-Atl	NC	None
14	Cape May NWR	NWR	Y	Fed	Atlantic	Mid-Atl	NJ	None
15	Cape Romain NWR	NWR	Y	Fed	Atlantic	So-Atl	SC	None
16	Cedar Island NWR	NWR	Y	Fed	Atlantic	Mid-Atl	NC	None
17	Charleston Deep MPA	MPA	N	Fed	Atlantic	So-Atl	SC	HAPC
18	Chesapeake Bay NERR-MD	NERR	N	Fed/State	Atlantic	Mid-Atl	MD	None
19	Chesapeake Bay NERR-VA	NERR	N	Fed/State	Atlantic	Mid-Atl	VA	None
20	Chicoteague NWR	NWR	Y	Fed	Atlantic	Mid-Atl	VA	None
21	Cumberland Island NS	NPS	Y	Fed	Atlantic	So-Atl	GA	None
22	Currituck NWR	NWR	Y	Fed	Atlantic	Mid_Atl	NC	None
23	Delaware Estuary	NEP	N	Fed	Atlantic	Mid-Atl	DE	None
24	Delaware Inland Bays	NEP	N	Fed	Atlantic	Mid-Atl	DE	None
25	Delaware Bay NERR	NERR	N	Fed/State	Atlantic	Mid-Atl	DE	None
26	Eastern Neck NWR	NWR	Y	Fed	Atlantic	Mid-Atl	MD	None
27	Eastern Shore of Virginia NWR	NWR	Y	Fed	Atlantic	Mid-Atl	VA	None
28	Edisto MPA	MPA	N	Fed	Atlantic	So-Atl	SC	HAPC
29	Edwin B. Forsythe NWR	NWR	Y	Fed	Atlantic	Mid-Atl	NJ	None
30	False Cape State Park	Park	Y	State	Atlantic	Mid-Atl	VA	None
31	Featherstone NWR	NWR	Y	Fed	Atlantic	Mid-Atl	VA	None
32	Fisherman Island NWR	NWR	Y	Fed	Atlantic	Mid-Atl	VA	None
33	Georgia MPA	MPA	N	Fed	Atlantic	So-Atl	GA	None
34	Gray's Reef NMS	NMS	Y	Fed	Atlantic	So-Atl	GA	None
35	Guana Tolomato Matanzas NERR	NERR	Y	Fed/State	Atlantic	So-Atl	FL	None
36	Harris Neck NWR	NWR	Y	Fed	Atlantic	So-Atl	GA	None

Table C-43. Areas of Special Concern in and along the Mid- and South Atlantic Planning Areas (Continued).

No.	Name	Type	NSMPA	Fed/State	Region	Planning Area	State	EIA
37	Jacques Cousteau NERR	NERR	Y	Fed/State	Atlantic	Mid-Atl	NJ	None
38	Mackay Island NWR	NWR	Y	Fed	Atlantic	Mid-Atl	NC/VA	None
39	Martin NWR	NWR	Y	Fed	Atlantic	Mid-Atl	MD	None
40	Maryland Coastal Bays	NEP	N	Fed	Atlantic	Mid-Atl	MD	None
41	Merritt Island NWR	NWR	Y	Fed	Atlantic	So-Atl	FL	None
42	Monitor NMS	NMS	Y	Fed	Atlantic	Mid-Atl	NC	None
43	North Carolina NERR	NERR	Y	Fed/State	Atlantic	Mid-Atl	NC	None
44	North Florida MPA	MPA	N	Fed	Atlantic	So-Atl	FL	None
45	North Inlet-Winyah Bay NERR	NERR	Y	Fed/State	Atlantic	So-Atl	SC	None
46	Northern South Carolina MPA	MPA	N	Fed	Atlantic	So-Atl	SC	HAPC
47	Occoquan Bay NWR	NWR	Y	Fed	Atlantic	Mid-Atl	VA	None
48	Pea Island NWR	NWR	Y	Fed	Atlantic	Mid-Atl	NC	None
49	Pinckney Island NWR	NWR	Y	Fed	Atlantic	So-Atl	SC	None
50	Plum Tree Island NWR	NWR	Y	Fed	Atlantic	Mid-Atl	VA	None
51	Prime Hook NWR	NWR	Y	Fed	Atlantic	Mid-Atl	DE	None
52	Sapelo Island NERR	NERR	N	Fed/State	Atlantic	So-Atl	GA	None
53	Snowy Grouper Wreck MPA	MPA	N	Fed	Atlantic	Mid-Atl	NC	HAPC
54	Supawna Meadows NWR	NWR	Y	Fed	Atlantic	Mid-Atl	NJ	None
55	Susquehanna NWR	NWR	Y	Fed	Atlantic	Mid-Atl	MD	None
56	Swanquarter NWR	NWR	Y	Fed	Atlantic	Mid-Atl	NC	None
57	Tybee NWR	NWR	Y	Fed	Atlantic	So-Atl	SC	None
58	Waccamaw NWR	NWR	Y	Fed	Atlantic	So-Atl	SC	None
59	Wallops Island NWR	NWR	Y	Fed	Atlantic	Mid-Atl	VA	None
60	Wassaw NWR	NWR	Y	Fed	Atlantic	So-Atl	GA	None
61	Wolf Island NWR	NWR	Y	Fed	Atlantic	So-Atl	GA	None

9.3.1.1.1. National Park System (National Seashores)

National Seashores are coastal areas with federal designations indicating they have natural and recreational significance. All national parks are required to have an approved General Management Plan that provides a framework to guide decisions for natural and cultural resource protection, appropriate types and levels of visitor activities, and appropriate facility development (USDOI, NPS, 2011). There are five National Seashores adjacent to the Atlantic Program Area that are administered by the NPS: Assateague Island National Seashore, Cape Hatteras National Seashore, Cape Lookout National Seashore, Cumberland Island National Seashore, and Canaveral National Seashore (**Figure C-81**) (USDOI, NPS, 2015). Established in 1953, Cape Hatteras is the oldest National Seashore, while Canaveral, established in 1975, is the newest.

Assateague Island National Seashore is part of a barrier island that extends from the Ocean City, New Jersey inlet to the Maryland-Virginia state border encompassing approximately 167 km^2 (64.5 mi^2).

The park is important for resting and feeding migratory shorebirds and more than 320 species of birds can be found there.

Cape Hatteras National Seashore encompasses 122.8 km^2 (47.4 mi^2) and preserves the portion of the Outer Banks of North Carolina from Bodie Island to Ocracoke Island. The area provides a variety of valuable wintering habitats for migrating waterfowl.

Cape Lookout National Seashore preserves a 90-km (56-mi) section of the southern Outer Banks of North Carolina, running southeast from Ocracoke Inlet to Beaufort Inlet. Three undeveloped barrier islands make up the seashore, the North and South Core Banks and Shackleford Banks. The area encompasses 114.3 km^2 (44.13 mi^2) and provides valuable habitat for threatened and endangered nesting sea turtles, Wilson's plover, and red knot.

Cumberland Island National Seashore preserves most of Cumberland Island in Camden County, Georgia. The park encompasses 147.4 km^2 (56.9 mi^2) on a barrier island, including ocean, beach, dune, hammock, lagoon, salt marsh, and pine flatland habitats. Endangered species utilizing the seashore's habitats include loggerhead, green, and leatherback turtles; West Indian manatee; Southern bald eagle; wood stork; peregrine falcon; Florida scrub jay (*Aphelocoma coerulescens*); and eastern indigo snake.

Canaveral National Seashore is located between New Smyrna Beach and Titusville, Florida. The park encompasses 233.4 km^2 (90.1 mi^2) and provides habitat for >1,000 plant species and 310 bird species as well as 13 species of federally listed threatened or endangered animals: loggerhead, green, Kemp's ridley, and leatherback turtles; West Indian manatee; Southern bald eagle; wood stork; peregrine falcon; Florida scrub jay; Atlantic salt marsh (*Nerodia clarkia*) and eastern indigo snakes; southwestern beach mouse (*Peromyscus polionotus*); and NARW.

9.3.1.1.2. National Wildlife Refuges

There are currently 11 NWRs located adjacent to the Atlantic Program Area (Figure C-81). All land within the NWR system is managed toward the goal of conserving and restoring the nation's fish and wildlife habitat. Management approaches and conservation methods differ among NWRs but typically include managing and rehabilitating wildlife habitat, controlling invasive species, and assisting in the recovery of rare wildlife species (USDOI, USFWS, 2015).

Mid-Atlantic Planning Area

Chincoteague NWR encompasses 56.7 km^2 (21.9 mi^2) of beach, dunes, marsh, and maritime forest habitats. The refuge was established to provide habitat for migratory birds (with an emphasis on conserving greater snow geese [*Chen caerulescens*]) and supports habitat for waterfowl, wading birds, shorebirds, and songbirds as well as other species of wildlife and plants.

Wallops Island NWR encompasses 1.51 km^2 (0.58 mi^2) of salt marsh and woodlands in Virginia. The refuge contains habitat for a variety of species, including upland- and wetland-dependent migratory birds, while eagles and great horned owls (*Bubo virginianus*) use it to nest and raise young. Habitat in the refuge includes sealevel fens, an extremely rare type of coastal wetland distinguished from marshes and bogs by having a distinct hydrologic regime and unique associations in vegetation.

The eastern shore of Virginia NWR is located at the tip of the Delmarva Peninsula in Virginia and is one of the most important North American funnels for avian migration. The refuge encompasses 4,561 km^2 (1.761 mi^2) and provides habitat for >400 species of birds. The NWR is used for management and study of endangered species, including the piping plover and the northeastern beach tiger beetle (*Cicindela dorsalis dorsalis*).

A Wetland of International Importance, Fisherman Island NWR encompasses 7.5 km^2 (2.9 mi^2) at the entrance to Chesapeake Bay. It is the southernmost island on Virginia's Delmarva Peninsula chain of barrier islands. The refuge provides habitat for migratory waterfowl, shorebirds, and nesting waterbirds.

Plum Tree Island NWR encompasses 14.2 km^2 (47 mi^2) in Virginia on the southwestern corner of Chesapeake Bay. The refuge is an important stopover site for migratory birds using the Atlantic Flyway and provides protected breeding habitat for federal and state-listed threatened and endangered species as well as many migrating bird species. The NWR has special conservation status designations as an MPA, a Ramsar Wetland of International Importance, and a Western Shore Marshes IBA.

Back Bay NWR also is a critical segment in the Atlantic Flyway and provides feeding and resting habitat for migratory birds. The refuge is located in southeastern Virginia and encompasses 36.7 km^2 (14.2 mi^2) of beach, dune, woodland, and emergent freshwater marsh habitats. Back Bay NWR provides habitat for threatened and endangered species, including the loggerhead sea turtle and piping plover, as well as recently recovered species such as the eastern brown pelican and bald eagle.

South Atlantic Planning Area

Currituck NWR encompasses 33.7 km^2 (13 mi^2) on the northern end of North Carolina's Outer Banks and was established to preserve and protect the coastal barrier island ecosystem. The refuge provides wintering habitat for waterfowl and protects endangered species such as piping plover, sea turtles, and seabeach amaranth (*Amaranthus pumilus*).

Pea Island NWR encompasses 127.6 km^2 (49.3 mi^2) in the Outer Banks of North Carolina and provides nesting, resting, and wintering habitat for migratory birds, including greater snow geese and other migratory waterfowl, shorebirds, wading birds, raptors, and neotropical migrants. The refuge also provides habitat and protection for endangered and threatened species such as loggerhead, leatherback, and green turtles; least tern; American oystercatcher; and piping plover.

Cape Romain NWR encompasses 268.3 km^2 (103.6 mi^2) in southeastern South Carolina. Habitats within the NWR include barrier islands, salt marshes, coastal waterways, sandy beaches, fresh and brackish water impoundments, and maritime forest. The NWR was established as a migratory bird refuge to preserve habitat for waterfowl, shorebirds, and resident species. In recent years, the refuge's purpose was expanded to include endangered species recovery, protecting and managing a Class I Wilderness Area, and preserving the Bulls Island and Cape Island forests and plant communities. The refuge supports 18 to 22 shorebird species in the Atlantic Flyway, including red knot, American oystercatcher, Wilson's plover, whimbrel (*Numenius phaeopuson*), and least tern, and also provides valuable habitat for loggerhead turtles.

Blackbeard Island NWR encompasses 22.7 km^2 (8.8 mi^2) on a barrier island in McIntosh County, Georgia, and was established as breeding ground for native wildlife and migratory birds. The island comprises interconnecting linear dunes thickly covered byoak/palmetto vegetation, with freshwater marsh, salt marsh, maritime forest, and sandy beach habitats. The primary objectives of the refuge are to provide: wintering habitat and protection for migratory birds; protection and habitat to promote resident and migratory wildlife diversity; protection and management for endangered, threatened, or recently recovered species, including the loggerhead turtle, bald eagle, wood stork, and piping plover.

Wassaw NWR encompasses 40.7 km^2 (15.7 mi^2) on a barrier island off the coast of Georgia. Refuge habitats include beaches with rolling dunes, maritime forest, and salt marshes, which support rookeries for egrets and herons as well as a variety of wading birds and also provides habitat for nesting sea turtles.

9.3.1.1.3. National Estuarine Research Reserves and National Estuary Program

NERRs in or near the Atlantic Program Area are as follows (**Figure C-81**):

- Delaware Bay Reserve;
- Chesapeake Bay Reserve in Maryland and Virginia;
- North Carolina NERR;
- North Inlet-Winyah Bay NERR in South Carolina;
- ACE Basin NERR in South Carolina; and
- Sapelo Island NERR in Georgia.

Mid-Atlantic Planning Area

The Delaware Bay Reserve consists of 4.4 km² (1.7 mi²) of freshwater wetlands, ponds, and forest lands in Blackbird Creek, and 20.7 km² (8.0 mi²) of salt marsh and open water habitats on the St. Jones River on Delaware Bay. The reserve is a major spawning area for horseshoe crabs each spring; horseshoe crab eggs provide fuel for migratory shorebirds on their way to the Arctic from the Southern Hemisphere.

The Chesapeake Bay Reserve is the largest U.S. estuary, encompassing 37.7 km² (14.6 mi²), and contains diverse habitats, including oyster reefs, seagrass beds, tidal wetlands, sandy shoals, and mudflats.

South Atlantic Planning Area

North Carolina NERR is the third largest U.S. estuarine system, with 42.8 km² (16.5 mi²) of protected barrier islands, inlets, and estuaries. The NERR comprises four components located from north of Corolla, on the northern Outer Banks to south of Wilmington; the Currituck Banks component is on the marsh side of the Outer Banks in Albemarle Sound, the Rachel Carson component, the Masonboro Island component, and Zeke’s Island component.

North Inlet-Winyah Bay NERR protects >76.6 km² (29.6 mi²) of habitats ranging from tidal and transitional marshes to oyster reefs, beaches, and intertidal flats, including coastal island forests to open waterways. The reserve provides habitat for many threatened and endangered species, including sea turtles, sturgeons, least terns, and wood storks.

ACE Basin NERR is one of the largest undeveloped estuaries on the Atlantic Coast, protecting an area of 401.9 km² (155.2 mi²). The NERR preserves habitat for many endangered or threatened species such as shortnose sturgeon, wood Storks, and loggerhead turtles.

Sapelo Island NERR occupies just over one-third of Sapelo Island, the fourth largest barrier island in Georgia, and encompasses 24.7 km² (9.5 mi²) of the Duplin River and its estuary, upland maritime forest and hammock land, and tidal salt marsh. Endangered and threatened species in the NERR include Southern bald eagles, peregrine falcons, ospreys, Eastern brown pelicans, wood storks, Wilson’s plovers, American alligators, loggerhead turtles, NARW, and West Indian manatees.

9.3.1.1.4. National Estuary Program

Although not designated as MPAs, three NEP sites occur along coasts adjacent to the Atlantic Program Area (NEP, 2011): Delaware Inland Bays, Maryland Coastal Bays (adjacent to the Mid-Atlantic Planning Area), and Albemarle-Pamlico Sounds in North Carolina (adjacent to the South Atlantic Planning Area). Also, the Chesapeake Bay Program (2011) encompasses Chesapeake Bay waters in Virginia, Maryland, Delaware, and Pennsylvania (**Figure C-81**).

9.3.2. Marine Areas of Special Concern

9.3.2.1. Marine Protected Areas

9.3.2.1.1. National Marine Sanctuaries

Mid-Atlantic Planning Area

There is one NMS within the Mid-Atlantic Planning Area, the Monitor NMS, located off the coast of North Carolina (**Figure C-81**); it is administered by NOAA’s ONMS. The Monitor NMS is located 26 km (14 nmi) off Cape Hatteras, North Carolina. The USS *Monitor* was a Civil War ship and the Navy’s first ironclad warship. The USS *Monitor* sank off Cape Hatteras during a storm in December 1862, and its location was unknown until 1973 when the ship was found 30 km (14 nmi) off Cape Hatteras in 70 m (230 ft) of water. In 1975, the USS *Monitor* site was named the nation’s first NMS (Monitor NMS, 2011). Monitor NMS is closed to the public, with access restricted to scientific research and management officials. Federal regulations prohibit certain activities in Monitor NMS, including anchoring, unauthorized diving, cable laying, coring, dredging, drilling, detonating explosives, conducting salvage operations, trawling, or discharging wastes in violation of federal regulations (15 CFR § 922.61).

South Atlantic Planning Area

Gray's Reef NMS is the only NMS within the South Atlantic Planning Area. Gray's Reef NMS is located 32 km (17 nmi) east of Sapelo Island, Georgia and encompasses an area of 57.4 km^2 (22.2 mi^2) (**Figure C-81**); it is administered by NOAA's ONMS (Gray's Reef National Marine Sanctuary, 2011b). Designated in 1981 as the nation's fourth marine sanctuary to protect the unique hard bottom habitat that supports a variety of sessile organisms (e.g., sponges, corals, sea fans, and barnacles), Gray's Reef NMS has been recognized as a unique bioregion by the United Nations. Invertebrates constitute the live hard bottom and support reef fishes (e.g., black sea bass, snappers, groupers, and mackerels) as well as the threatened loggerhead sea turtle. Gray's Reef is within the winter calving ground for the endangered NARW, which is occasionally seen in the sanctuary. The reef is also a popular dive site and the largest nearshore live bottom habitat available to recreational fishers in Georgia. Federal regulations (15 CFR § 922.92) prohibit certain activities in Gray's Reef NMS, including anchoring; dredging, drilling, or altering submerged lands; constructing, placing, abandoning any structure, material or other matter on submerged lands; discharging or depositing any material; injuring, catching, harvesting or collecting marine organisms; using explosives or devices that produce electric charges; and breaking, cutting, damaging, taking, or removing any bottom formation or sanctuary historical resource.

9.3.2.1.2. Deepwater Marine Protected Areas

Deepwater MPAs have been established in the Atlantic Program Area through implementation of Amendment 14 to the Snapper Grouper Fishery Management Plan (SAFMC, 2007). The MPAs are designed to protect a portion of the long-lived deepwater snapper-grouper species such as blueline tilefish (*Caulolatilus microps*), snowy grouper (*Epinephelus niveatus*), and speckled hind (*Epinephelus drummondhayi*). In these deepwater MPAs, fishing for or possessing any of the 73 species in the snapper-grouper complex species is prohibited, as is shark bottom longline gear. Commercial and recreational vessels may transit the area using direct non-stop progression with snapper-grouper complex species on board and with fishing gear appropriately stowed. Trolling for pelagic species, including tuna, dolphinfish, mackerel, and billfish is allowed within the MPAs. Information in this section is from the SAFMC (2011b).

Mid-Atlantic Planning Area

One deepwater MPA (Snowy Grouper Wreck MPA) and a portion of another (Northern South Carolina MPA) have been established in the Mid-Atlantic Planning Area. The Snowy Grouper Wreck MPA, named for the spawning aggregations that used to occur there, encompasses 514 km^2 (150 nmi^2) approximately 102 km (55 nmi) southeast of Southport, North Carolina and east of Cape Fear. The MPA includes a wreck site and there may be smaller wrecks in the area. Substantial hard bottom habitat could protect a portion of deepwater snapper-grouper species as well as some mid-shelf species from directed fishing pressure. Demersal fishes known to frequent the area include gag grouper, graysby (*Cephalopholis cruentata*), hogfish (*Lachnolaimus maximus*), red grouper (*Epinephelus morio*), red porgy (Pagrus pagrus), snowy grouper, and speckled hind. Prior to the MPA designation, the Snowy Grouper wreck site was mostly fished by commercial snapper-grouper fishers out of Little River, South Carolina, and the ports of Carolina Beach and Southport, North Carolina. The area also was heavily trolled for dolphinfish, marlin, tuna, and wahoo during certain times of the year. After the discovery of the wreck in the 1990s, the area was quickly fished down.

The Northern South Carolina MPA encompasses 171 km2 (50 nmi^2) approximately 100 km (54 nmi) from Murrells Inlet, South Carolina. The MPA occurs in both the Mid- and South Atlantic Planning Areas (**Figure C-81**). It contains areas of low relief and hard bottom habitat consisting of eroded rock in shelf-edge water depths where vermilion snapper (*Rhomboplites aurorubens*) are found. Prior to MPA designation, fishing focused on deepwater species such as snowy grouper, speckled hind, and yellowedge grouper (*Hyporthodus flavolimbatus*) as well as gag grouper, red porgy, and triggerfish. The site could protect several species of deepwater snappers and groupers, mid-shelf species, and associated habitat.

South Atlantic Planning Area

Eight deepwater MPAs have been established in the South Atlantic region. Four are within the Atlantic Program Area and one occurs in both the Mid- and South Atlantic Planning Areas (**Figure C-81**).

Located 83 km (45 nmi) southeast of Charleston Harbor, South Carolina, the 50-nmi2 (171-km^2) Edisto MPA was heavily fished by both commercial and recreational fishers prior to the MPA designation. Species such as black sea bass, blueline tilefish, gag, scamp, juvenile snowy grouper, red porgy, speckled hind, and vermilion snapper reside in this shelf-edge habitat.

The Charleston Deep Reef MPA is a 6.5 by 11 km (3.5 by 6 nmi) area proposed as an experimental artificial reef site located approximately 93 km (50 nmi) southeast of Charleston Harbor, South Carolina. There is no hard bottom in the area. Any biological benefits to deepwater species would accrue after artificial reef materials such as sunken ships, tanks, or highway materials are added to improve habitat and attract fishes. Long-term study of this site may provide important biological information about deepwater snapper-grouper species and the effectiveness of deepwater artificial reefs.

The Georgia MPA is located 128 km (69 nmi) southeast of the mouth of Wassaw Sound, Georgia, and covers an area of 343 km^2 (100 nmi^2). Although most fishing in the area is for pelagic species such as tunas and dolphin, species such as snowy grouper and golden tilefish (*Lopholatilus chamaeleonticeps*) were often caught prior to the MPA designation. This area lies east of an area called the "Triple Ledge" that is an important area for commercial fishers and was occasionally fished commercially for snapper-grouper species.

Located 111 km (60 nmi) off the mouth of the St. Johns River near Jacksonville, Florida, the 343-km^2 (100-nmi^2) North Florida MPA has some mud bottom habitat and shelf-edge reef of slab pavement, blocked boulders, and buried blocked boulders. Snowy grouper and speckled hind have been caught in the area, and the mud bottom may also be habitat for golden tilefish. Some mid-shelf species that also are likely to inhabit the area include vermilion snapper, hogfish, scamp, red porgy, and tomtate (*Haemulon aurolineatum*). While this MPA is outside the Atlantic Program Area, it could be impacted during a spill event.

9.3.2.1.3. Other Federal Fishery Management Areas

Numerous other federal fishery management areas have been designated by NMFS, the SAFMC, and the MAFMC. These areas have restrictions on certain types of fishing that, although not directly relevant to the proposed action, are important because of the protected resources and the types of activities that are prohibited. **Section 13.3.1** discusses commercial fishing closures and restrictions.

10.0. ARCHAEOLOGICAL AND HISTORICAL RESOURCES

Archaeological and historical resources are defined as any material remains of human life or activities that are at least 50 years of age and that are of archaeological interest (30 CFR 550.105). The National Historic Preservation Act (NHPA, 54 U.S.C. 300101 *et seq.*) established a national program to preserve the country's historical and cultural resources. Section 106 of the NHPA requires all federal agencies to consider the effects of their actions on historic properties, those on or eligible for the *National*

Register of Historic Places. The tenets of the 106 process include: identification of cultural resources within the area of potential effect of a federal project, assessment of the project's impact on cultural resources, and development of measures to mitigate or minimize a federal project's impact on historic resources. BOEM and the Bureau of Safety and Environmental Enforcement (BSEE) are the agencies charged with instituting procedures to ensure that federal plans and programs contribute to the preservation and enhancement of non-federally owned sites, structures and objects of historical, architectural or archaeological significance on the OCS (USDOI, BOEM, 2015). BOEM and BSEE have published guidelines for performing archaeological surveys in the OCS (**Appendix G**).

10.1. ALASKA PROGRAM AREAS

Submerged cultural resources within the Alaska Program Areas include shipwrecks that date from early exploration and settlement of the Pacific Arctic region by Europeans as early as the mid-18th century. Submerged pre-contact sites dating between 20,000 and 3,000 yr before present (B.P.) also may be present within the Alaska Program Areas, depending on regional landform variation. Adjacent onshore areas also hold the potential to contain cultural resources, which could be affected by oil and gas activities. Historic resources can include individual residences (such as indigenous sites that may be composed of housepits, cache pits, ice cellars, and related features), churches, inns, trading posts, lighthouses, fishing and mining camps, and piers and docks. In the Arctic, onshore coastal pre-contact sites are often found in association with certain geologic features. These features include morainal high-ground, lake-shore and stream-shore environments and terraces, and barrier islands. In the Cook Inlet area, archaeological sites are generally found in well-drained settings along the coast and inland.

The Alaska Program Areas includes federal waters in three areas: the Beaufort Sea, Chukchi Sea, and Cook Inlet. The Beaufort Sea Program Area excludes Presidential Withdrawal Areas, including the Barrow and Kaktovik subsistence bowhead whaling areas. The Chukchi Sea Program Area also excludes the Presidential Withdrawal Areas, including a 40-km (25-mi) coastal buffer, which is recognized as an important bowhead whale migration corridor, a subsistence area, and Hanna Shoal. The Cook Inlet Program Area only includes the portion of the Cook Inlet Planning Area north of Augustine Island. In Alaska, offshore oil and gas activities generally begin at the federal-state boundary 5.6 km (3 nmi) offshore with exceptions at predefined Presidential Withdrawal Areas such as the Chukchi Sea 40-km (25-mi) buffer. In this discussion, "nearshore" refers to waters from the shoreline to the 35-m (115-ft) depth contour, the approximate limit for ice gouging impacts. "Offshore" refers to the zone extending from the 35-m (115 ft) depth contour to the outer boundary of the Alaska Program Areas.

10.1.1. Historic Shipwrecks and Aircraft

European explorers have been active in waters off Alaska since the mid-18th century. Russian explorers first sighted the North American continent in 1741, but it was not until the 1780s that a permanent presence in Alaska was established with the Shelikov-Golikov Company Trading Post at Three Saints Bay on Kodiak Island (USDOI, BOEM, 2012b). Historic shipwrecks within the Alaska Program Areas date from the 18th century until modern times. Other resources that may be located in the Program Areas include historic aircraft. Air travel was first introduced in 1913 when James V. and Lillian Martin demonstrated the potential of this form of transportation to spectators in Fairbanks (Alaska History and Cultural Studies, 2015). Though air travel became a regular occurrence during the 1920s, the rugged terrain and often adverse weather conditions common in Alaska inevitably led to losses. Perhaps the most well-known aircraft loss in Alaska is the crash of Sigismund Levanevsky and five Russian crewmates in the Arctic Region on August 12, 1937 (Rozell, 2000).

The number of shipwrecks and obstructions in the Alaska Program Areas were estimated using information from various public and proprietary databases , and a variety of secondary sources (Berman, 1973; Tornfelt and Burwell, 1992; Bockstoce, 2006; USDOI, BOEM, 2011). Bockstoce (2006) compiled shipping losses during the whaling era in Arctic waters (1849 to 1899).

For a number of reasons, the shipwreck databases are unreliable. In addition to spatial inaccuracy due to reporting and navigational errors, the databases may be unreliable because they count ships that were later salvaged as shipwrecks. This seems to have been common in the past; for example, the *Duchess of Bedford* wrecked in Japan but was salvaged and purchased by Mikkelson and Leffingwell for providing transportation to Flaxman Island in the Beaufort Sea (Mikkelson et al., 1909; Leffingwell, 1919). Salvaging shipwrecks inflates the number of actual potential cultural resources found in and contiguous to the OCS. Finally, the reported losses are heavily skewed toward 19th to 20th Century commercial vessels, and under report other types of watercraft.

Review of the above databases and secondary sources identified 193 known wrecks, obstructions, archaeological sites, occurrences, or sites marked as "unknown" in the Alaska Program Areas with locational information (**Figure C-82**). Nine of these sites are located in the Cook Inlet Planning Area and 184 are located in the Beaufort Sea and Chukchi Sea Planning Areas. These numbers only include losses from the three planning areas and do not include resources from within exclusion zones. All nine (100 percent) of the Cook Inlet sites are located in waters deeper than 35 m (115 ft) in the offshore zone. In the Beaufort Sea and Chukchi Sea Planning Areas 56 (30.4 percent) are within the 35-m (115-ft) depth contour in the nearshore zone and 126 (69.6 percent) are in deeper waters of the offshore zone. Another two sites with locational information were identified in the databases in the vicinity of Hanna Shoal. None were found near Herald Shoal.

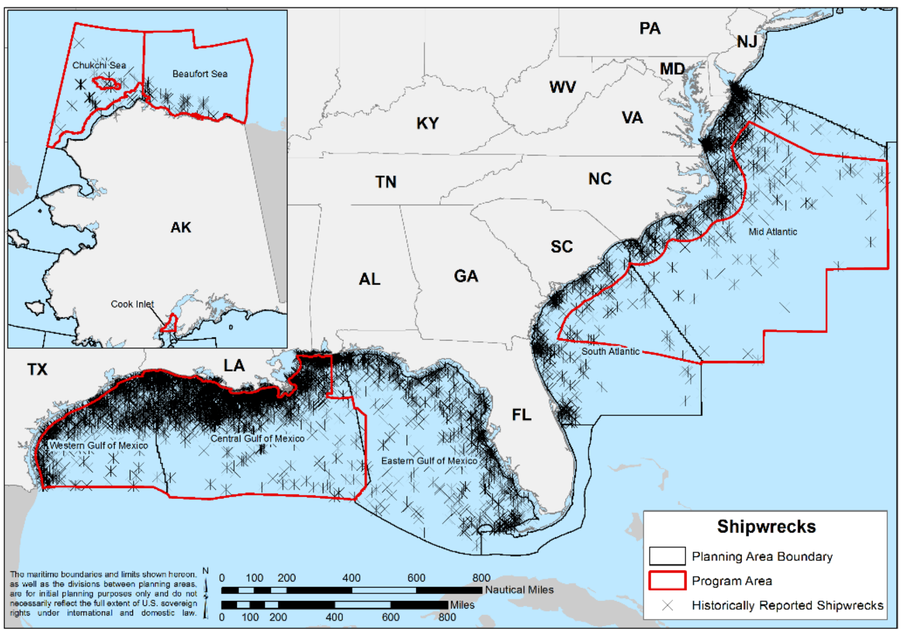


Figure C-82. Historically Reported Shipwrecks in the Alaska, Gulf of Mexico, and Atlantic Program Areas.

Those wrecks found within Cook Inlet date between the 1890s and 1988. In the Beaufort and Chukchi Seas, the majority of shipwrecked vessels are associated with the commercial whaling industry, which occurred between 1849 and 1921 (USDOI, BOEM, 2012b). A further distinction in commercial vessel losses can be made concerning the three planning areas. Listings of commercial losses in the Arctic region are limited to whaling ships and vessels supplying the villages and outposts along the north shore. In Cook Inlet, commercial losses can include any the above types of ships as well as fishing and other trading vessels. The number of losses should be considered underrepresented as discussed in **Section 10.1.1**. Even though many obstructions identified as "unknown" are eventually identified through diver or ROV investigation as modern debris, those that have not been investigated cannot be ruled out as potential submerged cultural resources.

The preservation potential of shipwrecks within waters off Alaska depends mainly on three factors: wave action/currents, ice, and temperature of the water column immediately above the seafloor. Wrecks located in nearshore areas are frequently subjected to intense wave action and currents from storms and ice gouging during the winter months. These environmental conditions are much reduced in the deeper waters of the OCS (>30 m [98 ft]) and wrecks located there have a greater potential for preservation. Findings from the "Jeremy Project" (1998), however, indicate that the assumption of a low potential for archaeological resources in high-density ice gouging areas may be more apparent than real.

That study, to locate the remains of the New Bedford Whaling Fleet lost off Point Belcher in 1871, identified the remains of four possible shipwreck sites in an area of known high density gouging (USDOI, BOEM, 2014; USDOI, MMS, 2007).

Within Cook Inlet volcanic activity further aids the preservation of shipwrecks through burial. There have been seven volcanic eruptions in the region in historic times. At least two area volcanoes, Mount Augustine and Mount Redoubt, located on the west side of the Cook Inlet Planning Area, have erupted more than once in historic times (Alaska Volcano Observatory, 2014a; 2014b). The low liquefaction potential and the angular particle size of the ash layer is more stable than the overlying silt and clay layers and is more resistant to erosion (USDOI, MMS, 2003a, Vol. 1). Since the 1912 Novarupta eruption at Katmai, located in the southwest corner of the Cook Inlet Project Area, sediment accumulation has ranged from approximately 8 cm in the northeastern part of the planning area to 84 cm in the central part (USDOI, MMS, 2003a, Vol. 1).

10.1.2. Pre-contact Resources

Submerged cultural resources also include pre-contact archaeological sites. At the height of the Late Wisconsin glacial period (approximately 19,000 yr B.P.) sea level was approximately 120 m (394 ft) lower than present. During times of lower sea level, a land bridge, Beringia, connected the Asian and North American continents. A synthesis of sea level data presented by Hopkins (1967) suggests that land bridges existed between Alaska and Siberia prior to 14,000, and at approximately 13,000, and 11,000 yr B.P. When Alaska was first populated approximately 14,800 yr B.P., sea levels were still approximately 60 m (197 ft) lower than present (Holmes, 2011; Potter et al., 2011). It is commonly thought that early inhabitants arriving in Alaska would have first settled along the coast (Darigo et al., 2007). Researchers postulate that if relic landforms such as stream terraces, morainal high-grounds, and coastal features (i.e., areas inshore of barrier islands) could be found and identified, they might further understanding of the human colonization of the Americas, and aid BOEM in determining areas which may or may not need archaeological analysis and mitigation prior to oil and gas activities (Darigo et al., 2007; Rogers, 2012).

A number of studies have been conducted to identify submerged landforms from the Holocene Period. An early study conducted by Dixon et al. (1986) sought to identify those areas of the Alaska OCS that have the highest potential for preserved pre-contact archaeological sites using geologic, bathymetric, geophysical, climatic, and archaeological data. Indicators used to evaluate offshore potential were onshore coastal geomorphic features, offshore relic geomorphic features, and ecological data. Results from that research suggested that the area around the Aleutian Islands had the greatest potential for preserved pre-contact sites (Dixon et al., 1986).

Elias et al. (1992) published a study of the Chukchi Sea region to identify potential relic landforms. While their inquiry indicated such landforms could exist, researchers acknowledged that ice gouging may have removed all evidence of archaeological remains. Darigo et al. (2007) performed a similar investigation for the Beaufort Sea area. That study also confirmed the potential for Holocene landforms; however, like Elias et al. (1992), Darigo et al. (2007) recognized that ice gouging and coastal erosion may have removed archaeological evidence.

As few field investigations have been performed on the Alaska OCS; the extent of disturbance to these submerged landforms is unknown. The limited research that has been conducted has been confined mostly to regions in the Beaufort and Chukchi Seas. Researchers surmise that some areas near barrier islands or areas protected by shorefast ice would exhibit less gouging and have a greater potential for intact archaeological resources (Darigo et al., 2007). However, findings from the "Jeremy Project" in which shipwreck remains have been located in areas of high-density ice gouging, and discovery of HMS *Erebus* of the "Lost Franklin Expedition" in Queen Maud Gulf off Nunavut, Canada in 11 m of water, suggest that the deleterious effects of sea ice on archaeological sites has less of an impact than previously assumed (CBC News - Canada, 2015; USDOI, BOEM, 2014; USDOI, MMS, 2007).

The preservation potential of offshore pre-contact sites within waters off Alaska depends mainly on two factors: wave action/currents, and ice. Sites located in nearshore areas are frequently subjected to intense wave action/currents from storms and ice gouging during the winter months. The tidal range for southern Cook Inlet is 8.5 m (27.9 ft) with an average current velocity of 3 to 4 kn (USDOI, MMS, 2003a, Vol. 1). The impacts of these environmental conditions are greatly reduced in the deeper waters of the OCS and landforms located there have a greater potential for preservation. The seafloor of lower Cook Inlet is characterized by lag gravels, sand ribbons, and sand wave fields (USDOI, MMS, 2003a, Vol. 1). These features are formed only in high-energy areas and currents in the area may have removed archaeological evidence through scour and erosion (USDOI, MMS, 1995, Vol. 2; USDOI, MMS, 2003a, Vol. 1).

Volcanic activity may aid in the preservation of offshore sites. Volcanic ash provides protection through burial by angular particle size sediments, which are more resistant to erosion than overlying silt and clay layers (USDOI, MMS, 2003a, Vol. 1).

Along the Arctic north coast, Holocene sediments are generally thin and composed of marine silts, clay, and fine-grained sands (USDOI, MMS, 2003b, Vol. 1). Lag gravels can be found in small patches just to the outside of barrier islands. Ice gouging, coastal bluff erosion, and storm surges have reworked the near shore shelf sediments and only those areas beneath shorefast ice and landward of barrier islands are protected from the more destructive geologic processes of the open shelf. The greatest potential for offshore site preservation is in those areas >70 km (43 mi) offshore and in depths >30 m (98 ft) (USDOI, MMS, 1990, Vol. 2).

10.2. Gulf of Mexico Program Area

Submerged cultural resources within the Gulf of Mexico Program Area include shipwrecks that occurred as early as the 16th and 17th centuries during exploration and settlement of North America and the Caribbean by Europeans. Historic resources also include historic structures constructed in offshore locations such as the Ship Shoal Lighthouse (Louisiana). Submerged pre-contact sites dating between 12,000 and 3,500 B.P. also may be present within the Gulf of Mexico Program Area, depending on regional landform variation. Adjacent onshore areas also hold the potential to contain cultural resources, which could be affected by oil and gas activities. Historic resources can include individual residences, shoreline communities, lighthouses, forts, piers, and docks. Onshore coastal pre-contact sites are often associated with certain geologic features, including river channels and associated floodplains, terraces, levees and point bars, barrier islands and back-barrier embayments, and salt domes.

The Gulf of Mexico Program Area includes federal waters in the Western, Central, and Eastern Planning Areas currently not subjected to moratoria, approximately from the Alabama/Florida state line in the east to the Rio Grande Estuary, Texas, in the west, and extending from the coastline to the EEZ, 370 km (200 nmi) seaward. In this discussion, "nearshore" refers to waters from the shoreline to the 40-m (131-ft) depth contour, the maximum limit for geological and geophysical (G&G) activities related to marine minerals and renewable energy development. "Offshore" refers to the zone extending from the 40-m (131 ft) depth contour to the outer boundary of the Gulf of Mexico Program Area.

10.2.1. Historic Shipwrecks

European explorers have been active in the Gulf of Mexico since the late 15th to early 16th centuries, but it was not until the second decade of the 16th century that explorers extensively traveled along the northern Gulf of Mexico within the Program Area. Shipwrecks within the Program Area date from the 16th century to modern times.

The number of shipwrecks and obstructions in the Gulf of Mexico Program Area were estimated using information from various public and proprietary databases, and a variety of secondary sources with information about shipwrecks within the Gulf of Mexico Program Area also were reviewed (Lytle and Holdcamper, 1975; Marx, 1987; and Berman, 1973). Lytle and Holdcamper (1975) compiled a comprehensive registry (known as the Lytle-Holdcamper List) of most steam vessels in the U.S. from 1790 to 1868. The list includes a section titled “Losses of United States Merchant Vessels, 1790–1868” that provides vessel name, tonnage, year built, nature of wreck, date, place, and lives lost. More than 3,800 vessels are listed as lost between 1790 and 1868. While the reference is general in nature and only covers American steam vessels through the Civil War, it provides an indication of the potential number and location of shipwrecks within the Gulf of Mexico Program Area. Marx’s book is a descriptive compilation of vessels lost in the Western Hemisphere between the time of Columbus and the second decade of the 19th century. Wreck data were compiled from a variety of primary and secondary sources. Berman’s work includes approximately 13,000 shipwrecks within American waters, excluding vessels <50 gross tons. Berman’s encyclopedia includes shipwrecks dating from the pre-Revolutionary era to modern times, in coastal waters and inland waterways.

Many of the shipwreck databases and secondary sources overlap, generating repetitive data. Additionally, these sources are far from comprehensive. They tend to focus on large merchant vessels and omit smaller coastal trading, fishing, and other locally built watercraft that may be present as shipwrecks in the nearshore zone of the Gulf of Mexico Program Area. Omission of smaller coastal watercraft from shipwreck databases underestimates the number of shipwrecks in the nearshore zone.

Review of the above databases and secondary sources identified 6,811 known wrecks, obstructions, archaeological sites, occurrences, or sites marked as “unknown” in the Gulf of Mexico Program Area with their locational information (**Figure C-82**). Of these sites, 4,776 (70 percent) are within the 40-m (131-ft) depth contour (nearshore zone) and 2,035 (30 percent) are in deeper waters (offshore zone). The number of offshore zone losses, however, should be considered underrepresented as there undoubtedly were many more sinkings that were not recorded as there may have been no survivors or witnesses from nearby vessels or shore to report the loss. Even though many obstructions identified as “unknown” are identified eventually through diver or remotely operated vehicle (ROV) investigation as modern debris, those that have not been investigated cannot be ruled out as potential submerged cultural resources.

The preservation potential of shipwrecks within the Gulf of Mexico Program Area depends on a number of factors including the rate of sedimentation at a wreck site, depth of the site, water currents, and temperature (USDOI, BOEM, 2012a, Vol. 2). Shipwrecks in areas with high sedimentation rates are expected to be better preserved. The western and central Gulf of Mexico, between Texas and Alabama, have sufficient sedimentary loads to bury shipwrecks, with those located down-current of the Mississippi River Delta having the best preservation potential.

Furthermore, wreck sites located in deepwater environments have a greater chance for preservation. Studies in 2004 and 2008 suggest that these areas are low-energy environments and wrecks in such areas are less likely to be dispersed (Church et al., 2004; Ford et al., 2008). In addition, the cold waters of these deep regions slow the oxidation process, helping reduce the corrosion of metal artifacts. However, investigation of the Mardi Gras Wreck noted wood preservation could be just as poor as in shallow water, due to the presence of species of wood-boring mollusks other than the naval shipworm (*Teredo navalis*), commonly found in shallow water sites (Ford et al., 2008).

Three studies sponsored by the NPS and MMS included models to identify areas in the Gulf of Mexico where shipwrecks might have occurred. The first of these studies, conducted by Coastal Environments, Inc. (CEI) in 1977, estimated that there were 2,500 to 3,000 wrecks within the Gulf of Mexico. The authors determined that approximately two-thirds of those wrecks lie within 1.5 km (0.8 nmi) of the coast, and most of the remainder could be found within 10 km (5.4 nmi) of the shoreline (CEI, 1977, Vol. 1). The study also concluded that shipwrecks should be concentrated around areas of intensive maritime activity such as the approaches and entrances to seaports and the mouths of navigable rivers and straits, and also around natural maritime hazards such as reefs and shoals.

Garrison et al. (1989) expanded upon CEI's work, utilizing statistical analyses to examine five factors affecting shipwreck locations: historic shipping routes, port locations, natural hazards (e.g., reefs, shoals), ocean currents and winds, and historic hurricane routes. This study concluded that 25 percent of wrecks occurred in the open seas, a reflection of changes in shipping routes during the late 19th to early 20th century (Garrison et al., 1989). The researchers divided the Gulf of Mexico into zones ranked by the potential for shipwrecks and the preservation potential of shipwrecks to help the MMS identify OCS lease blocks that would require archaeological surveys. However, remote sensing surveys conducted since 1989 and new shipwreck discoveries in the Gulf of Mexico have revealed deficiencies in the 1989 model. As a consequence, the MMS authorized an additional study by Pearson et al. (2003) to re-evaluate and refine the Garrison et al. (1989) study and other previous studies.

Pearson et al. (2003) utilized geographic information system (GIS) and nearly 15 years of new data from high-resolution oil and gas shallow hazard surveys to refine the previous models of shipwreck distribution and to complete probability analysis of shipwrecks in the Gulf of Mexico. By incorporating new variables and quantitative measurements in their analyses, the authors increased the number of lease blocks designated as having a high probability for shipwreck resources (Pearson et al., 2003). A number of these new lease blocks were located in deepwater regions, notably in areas of heavy maritime traffic such as the approaches to the Mississippi River. The information from the studies above prompted BOEM to revise the published guidance and gradually increased the number of lease blocks requiring archaeological surveys. As a result of BOEM requirements for archaeological survey in the OCS, at least 39 potential historic shipwreck sites have been identified since the implementation of the guidelines in 2005. Furthermore, within the last 6 years a dozen potential shipwrecks have been discovered by oil industry surveys in water depths up to 2,316 m (9,800 ft) (USDOI, BOEM, 2012a, Vol. 1). Nine of those potential sites have been visually confirmed as shipwrecks (USDOI, BOEM, 2012a, Vol. 1). BOEM currently requires archaeological survey for all new seafloor-disturbing activities.

10.2.2. Pre-Contact Resources

Submerged cultural resources also include pre-contact archaeological sites. Based on previous research, sea levels were approximately 90 to 130 m (295 to 427 ft) lower than present at the height of the last glacial period approximately 19,000 yr B.P. and did not reach current stands until approximately 3,500 B.P. (Pearson et al., 1986). Archaeological evidence indicates that the Gulf of Mexico region was occupied by pre-contact peoples as long ago as 12,000 yr B.P. Sea level curves produced by Coastal Environments Inc. (CEI) indicate that at that time sea levels were approximately 45 to 60 m (148 to 197 ft) below present levels (CEI, 1977, Vol. 1). Therefore, the continental shelf shoreward of this range of depth contours has the potential for containing pre-contact sites. Due to uncertainties in the rate of sea level rise and the time of entry of native populations into North America, BOEM has set the 60-m (197-ft) level as the seaward extent of the potential location of submerged pre-contact sites on the continental shelf.

Research conducted by CEI (1977, Vol. 1) identified a number of geomorphic features that have the potential to contain pre-contact sites. These features include barrier islands, back-barrier embayments, river channels and associated floodplains, terraces, and salt domes. The possibility of locating submerged pre-contact sites is greatest in the nearshore zone (<60 m [197 ft] deep) because portions of this area would have been exposed during the period of human occupation. Survival of sites on the OCS is attributed to a number of factors including degree of sediment overburden, low-energy wave environments, and the rate of sea level rise. In the Gulf of Mexico Program Area, Holocene deposits are thicker in west Texas and in the Mississippi delta region. Due to its complex of overlapping deltaic lobes, sites in the Mississippi Delta can be buried by as much as 91 m (300 ft) of Holocene sediment (USDOI, BOEM, 2012a, Vol. 2). In western Louisiana and eastern Texas, Holocene sediment is generally thin, and late Pleistocene deposits lie only a few meters below the seafloor. The McFaddin Beach Site (Texas

Historical Commission site number 41JF50) in Jefferson County, Texas, is an example of a site in this region. Artifacts dating between 11,500 and 400 yr B.P. have been found along the current shoreline and are thought to have resulted from redeposition of material from a now-submerged but eroding shoreline (Stright et al., 1999, Vol. 1). East of the Mississippi River, sediments are sandier and the general environment is more energetic. Further to the east along the western coast of Florida, the area is dominated by karst formations, and although located in a relatively low-energy environment, the region is sediment-starved. Sites in this region are typically found exposed on rocky outcrops above karstic river channels (Dunbar et al., 1989; Anuskiewicz and Dubar, 1993; Faught and Gusick, 2011).

The earliest recognized material culture that has been identified in the Paleo-Indian period in the U.S., called Clovis, is represented by distinctly basal fluted projectile points that date back to 12,500 B.P. This Paleo-Indian settlement pattern is described as semi-nomadic within a defined territory, reliant on reliable freshwater sources and cryptocrystalline raw material sources, and exploiting large and small game along with wild plants. As a result of this semi-nomadic settlement pattern, the Paleo-Indian sites most visible in the archaeological record most likely would be located proximal to freshwater sources that would have been visited repeatedly. Clovis cultural material can be found throughout most of the U.S.

Recently, sites have been discovered that may pre-date the Clovis culture. Cactus Hill and Saltville in Virginia show evidence of Clovis, and what appears to be pre-Clovis occupation. In central Texas, ongoing excavations at the Debra L. Friedkin Site are revealing a distinct assemblage of multifaceted flake tools that may indicate pre-Clovis occupation (Waters et al., 2011). Material from the site suggests occupation between 13,200 and 15,500 yr B.P. The original routes taken by migrants who eventually populated the U.S. might have followed the coast.

Conditions necessary for preservation of intact Paleo-Indian sites along the Gulf of Mexico OCS are variable and depend on geomorphological conditions and the rate of sea level rise. Current research on regional geology, relative sea level changes, and marine transgression are providing useful data concerning the possibility that there may be intact Paleo-Indian sites submerged along the Gulf of Mexico OCS. These submerged Paleo-Indian sites most likely would be found in the vicinity of paleochannels or river terraces that offer the highest potential of site preservation.

10.3. ATLANTIC PROGRAM AREA

Submerged cultural resources within the Atlantic Program Area include shipwrecks that date from early exploration and settlement of North America by Europeans as early as the 16th and 17th centuries. Historic resources include historic structures constructed in offshore locations such as Diamond Shoal and Frying Pan Shoal Lighthouses (North Carolina). Submerged pre-contact sites dating between 30,000 and 3,000 yr B.P. also may be present within the Atlantic Program Area. Adjacent onshore areas could contain cultural resources that could be affected by oil and gas activities.

The Atlantic Program Area includes federal waters in portions of the Mid-Atlantic and South Atlantic Planning Areas, approximately from the Maryland-Virginia state line in the north to the Georgia-Florida state line in the south, beginning at least 80.5 km (50 mi) offshore and extending from the coastline to the EEZ, 370 km (200 nmi) seaward.

10.3.1. Historic Shipwrecks

European voyagers have been exploring the Atlantic seaboard since approximately 1000 A.D., but it was not until the 16th century that expeditions reached the Mid-Atlantic and South Atlantic regions. Shipwrecks within the Program Area date from the 16th century until modern times.

Estimates regarding the number of shipwrecks and obstructions in the program area were calculated utilizing various public and proprietary databases, and a variety of secondary sources with information about shipwrecks within the program area were reviewed (Berman, 1973; Lytle and Holdcamper, 1975; and Marx, 1987). These sources, and their limitations, are discussed in **Section 10.2.1**.

Review of the above databases and secondary sources identified 706 known wrecks, obstructions, archaeological sites, occurrences, or sites marked as “unknown” in the Atlantic Program Area, with their locational information (**Figure C-82**). Of these sites, 28 (4 percent) are within the 40-m (131-ft) depth contour marking the nearshore zone and 678 (96 percent) are in deeper waters of the offshore zone. The seemingly low number of total wrecks and lack of nearshore losses is due to the 50-mi (813 km) buffer to oil and gas activities established off the Mid-Atlantic and South Atlantic Planning Areas. This buffer extends well beyond the 40-m (131-ft) contour in all but a few, small areas. Furthermore, the number of offshore zone losses should be considered underrepresented as there were undoubtedly many more sinkings that were not recorded due to the fact that there were no survivors to report the loss or witnesses from nearby vessels or shore. Even though diver or ROV investigation of many obstructions identified as “unknown” are eventually identified as modern debris, they cannot be ruled out as potential submerged cultural resources.

The preservation potential of shipwrecks in the Atlantic Program Area is similar to that noted for the Gulf of Mexico OCS. Sediment characteristics vary greatly along the Atlantic seaboard. The sand, silt, and mud bottoms that typically are found in the Atlantic Program Area offer greater preservation potential through burial than those in the north portions of the Atlantic OCS (TRC, 2012). Deepwater environments also influence the chance for preservation, as discussed in **Section 10.2.1**.

Three studies sponsored by the Bureau of Land Management (BLM) and the Bureau of Ocean Energy, Management, Regulation and Enforcement (BOEMRE) (now BOEM) included models to identify areas on the Atlantic OCS where shipwrecks may have occurred. The first of these studies, conducted by the Institute for Conservation Archaeology in 1979, presented a predictive model for the distribution and density of historic shipwrecks on the Atlantic OCS between the Bay of Fundy and Cape Hatteras. Researchers developed a model of shipwreck distribution and density based on four time periods: pre-1630, 1630 to 1800, 1800 to 1880, and 1880 to 1945. The study concluded that ships from the pre-1880 eras could be expected to cluster within the 5-fathom line while ships earlier the 1945 could be expected to be distributed inside the 10-fathom line (Institute for Conservation Archaeology, 1979). The researchers divided the study area into cultural resource zones, and made recommendations for the type and level of survey that should be performed within each as a guide for managing coastal and offshore development.

Science Applications, Inc. conducted a similar study focusing on shipwrecks between Cape Hatteras and Key West in 1981. Researchers assessed shipwreck potential within three different management zones based on varying levels of archaeological sensitivity. The level of archaeological survey recommended for each zone corresponded to its estimated level of archaeological sensitivity. Based on the available data acquired via literature searches, the study noted that approximately 90 percent of all known shipwrecks are located within the 20-m (65.6 ft) depth contour and that those within the 10-m (32.8 ft) depth contour represented the most sensitive resources with the greatest potential to be impacted (Science Applications, Inc., 1981). Researchers also offered survey strategies and management recommendations for each zone.

The most recent study, conducted by TRC Environmental Corporation, closely paralleled the Pearson et al. (2003) Gulf of Mexico study in content and goals (TRC Environmental Corporation, 2012). The distribution of wrecks along the Atlantic seaboard appears to be closely correlated to vessel traffic, especially in the vicinity of port approaches, estuary entrances, and navigational hazards. Researchers charted the density of shipwrecks and established zones of low, medium, and high probability for shipwreck resources. This model was designed to guide BOEM in cultural resource management planning, and offered strategies for conducting surveys on the Atlantic OCS (TRC Environmental Corporation, 2012).

10.3.2. Pre-contact Resources

Submerged cultural resources also include pre-contact archaeological sites. Based on current research, sea levels were approximately 70 m (230 ft) lower than present at the start of the Paleo-Indian period (30,000 yr B.P.) and were approximately 30 m (98 ft) lower than present around 10,000 yr B.P., rising to nearly 10 m (33 ft) below current levels by 6,000 yr B.P. (TRC Environmental Corporation, 2012).

The possibility of locating submerged pre-contact sites is greatest in the nearshore zone in <40 m [131 ft] water depth) because some of this area would have been exposed land during the period of pre-contact human occupation. TRC Environmental Corporation (2012) identified high sensitivity zones extending from depths of 0 to 70 m (0 to 230 ft) offshore the Mid-Atlantic and Georgia Bight. Low sensitivity zones included depths ranging from 70 to 120 m (230 to 394 ft) offshore the Mid-Atlantic and 70 to 110 m (230 to 361 ft) offshore the Georgia Bight. Areas deeper than 120 m (394 ft) offshore the Mid-Atlantic (or deeper than 110 m [361 ft] in the Georgia Bight) have no sensitivity (TRC Environmental Corporation, 2012).

Limited information regarding late Pleistocene/early Holocene sites and settlement patterns make it difficult to predict the location of submerged pre-contact cultural resources accurately. As a result, information from Archaic coastal terrestrial sites and research on paleolandscapes have enabled researchers to identify by using high-resolution remote sensing equipment which sort of land forms are likely to yield evidence of submerged pre-contact cultural resources. The most commonly seen and widely distributed on the Atlantic OCS are relic river channels found off the coasts of Virginia, South Carolina, and Georgia. Along the mid-Atlantic and as far south as the border between Georgia and Florida, rapid sea level rise may have increased the potential for preservation of Paleo-Indian and Archaic sites located in the vicinity of paleochannels.

Conditions necessary for preservation of intact Paleo-Indian sites along the Atlantic OCS are variable and depend on geomorphological conditions and the rate of sea level rise. Current research on regional geology, relative sea level changes, and marine transgression are providing useful data concerning the possibility that there may be intact Paleo-Indian sites submerged along the Atlantic OCS. These submerged Paleo-Indian sites most likely would be found in the vicinity of paleochannels or river terraces that offer the highest potential for site preservation.

11.0. POPULATION, EMPLOYMENT, AND INCOME

The following should be noted with respect to comments in this and other sections of the Appendix:

- The definition of “shoreline counties” is taken from NOAA materials and is counties that have a coastline bordering the open ocean, or contain FEMA identified coastal high hazard areas in the Special Flood Hazard Area.

- The unemployment rates quoted here may in actuality be higher. As economists have noted, due to the length of the recession there are individuals who have stopped looking for work.

11.1. ALASKA PROGRAM AREAS

The Cook Inlet Program Area encompasses the northern portion of the Cook Inlet Planning Area (Figure 2.1-1 in the Programmatic EIS). Municipalities and boroughs immediately adjacent to this planning area are the Municipality of Anchorage (MoA), Matanuska-Susitna (Mat-Su) Borough, and KPB; together, these account for approximately 62 percent of Alaska’s population (**Figure C-83**). Population growth trends for the MoA and the KPB between 2010 and 2014 were similar to population growth trends for the entire State of Alaska (**Table C-44**).

The North Slope Borough (NSB) is immediately adjacent to both the Beaufort Sea and Chukchi Sea Program Areas. The Northwest Arctic Borough borders the Chukchi Sea Program Area to the east (Figure 2.1-1 in the Programmatic EIS). The NSB has 9,711 residents, and the Northwest Arctic Borough has 7,774 residents. The population of Alaska’s Arctic makes up slightly more than 2 percent of the state's population (Alaska Department of Labor and Workforce Development [ADLWD], 2015) (**Table C-44**).

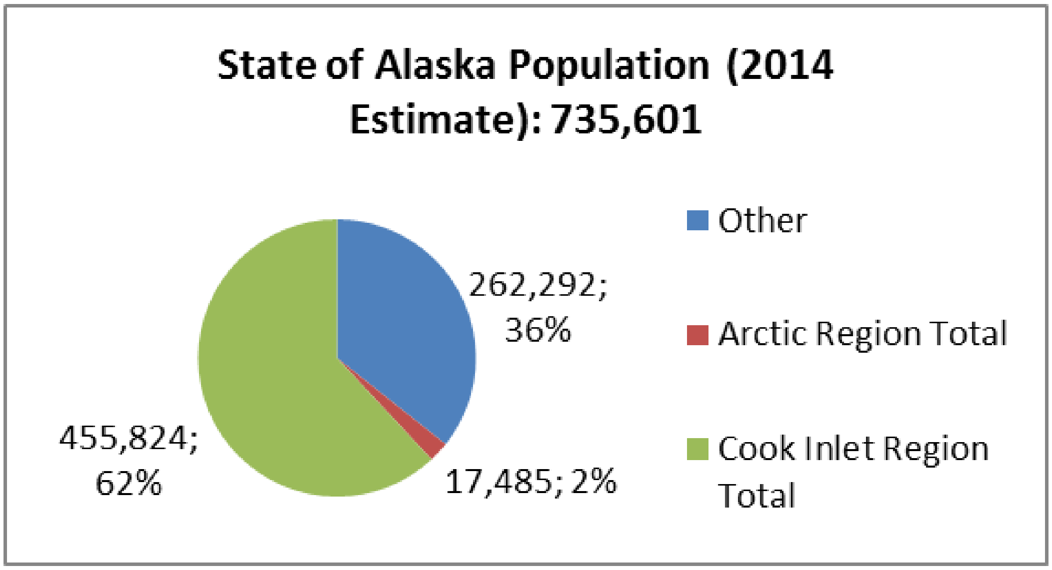
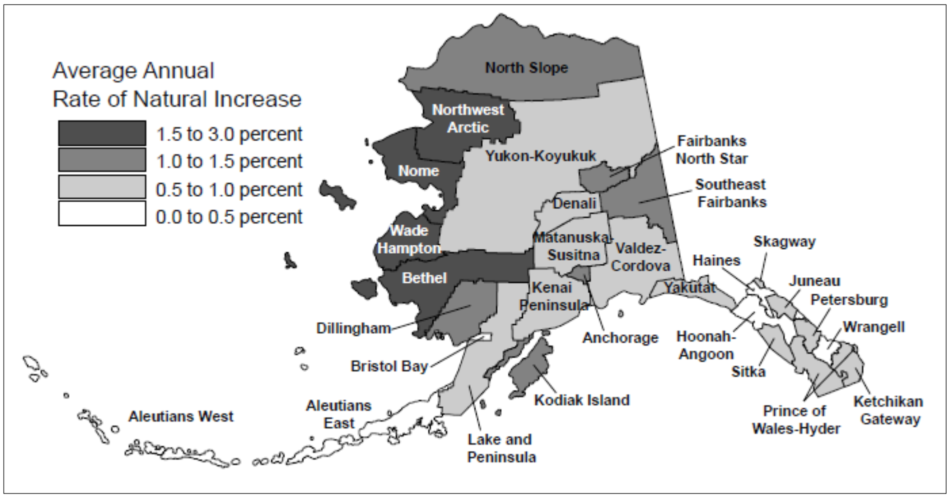


Figure C-83. Alaska Regional Population.

Table C-44. Alaska Regional Population (From: U.S. Census Bureau, 2014d[a]; ADLWD, 2015[b]).

Borough/Municipality	2000[a]	2010[a]	2014[b]
Anchorage	260,283	291,826	300,549
Kenai Peninsula	49,691	55,400	57,212
Matanuska-Susitna	59,322	88,995	98,063
Cook Inlet Region Total	**369,296**	**436,221**	**455,824**
North Slope	7,385	9,430	9,711
Northwest Arctic	7,208	7,523	7,774
Arctic Region Total	**14,593**	**16,953**	**17,485**
Alaska Total	**626,932**	**710,231**	**735,601**

The population of Alaska has demonstrated moderate and steady growth. Population changes throughout the boroughs are due to internal state migration by residents between boroughs as well as people moving to Alaska from the contiguous U.S. and internationally. **Figure C-84** shows the average annual rate of natural increase throughout the state at the borough level as well as the population increase due to migration within and to the state between 2010 and 2013.



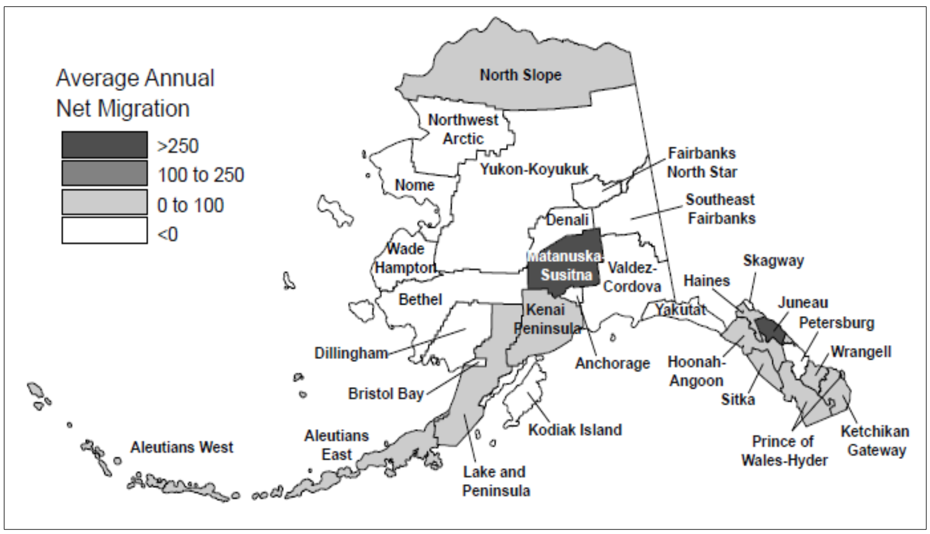


Figure C-84. State of Alaska Population Increases (From: ADLWD, 2015).

2013 statistics provided by the ADLWD Research and Analysis Section indicate that approximately 20.6 percent of the individuals working in Alaska are not residents of the state. Alaska’s seafood processing, tourism, and oil and gas industries account for a large portion of the non-resident workforce. The percentage of non-residents working in the oil and gas industry rose from 31.6 percent in 2012 to 33.6 percent in 2013 (ADLWD, 2013).

According to data gathered by the Alaska Native Tribal Health Consortium (ANTHC) in 2013, a total of 142,898 Alaska Native people lived throughout the state, representing 19 percent of the total estimated Alaskan population (ANTHC, 2015).

Alaska has a large and diverse military representation throughout the state. All branches of the military have a presence within Alaska, and combined, as of 2013 contributed 23,004 active duty military personnel with an approximate 33,052 dependents to Alaska’s overall population.

The ADLWD indicates that the population is projected to continue to grow faster than the contiguous 48 states and add nearly 200,000 people between 2012 and 2042. Population growth is expected to be more heavily centered in the Railbelt region, which includes Anchorage, Mat-Su Borough, Fairbanks North Star Borough, and KPB.

11.1.1. Beaufort Sea and Chukchi Sea Planning Areas

11.1.1.1. Community Population and Income

The 2014 population of the NSB was approximately 9,711 (ANTHC, 2015), contributing an estimated 56 percent to the Alaskan Arctic population (**Figure C-85**). The NSB's largest population center is the City of Barrow contributing 45 percent. In the Arctic Region, Barrow has the lowest average percentage of American Indian or Alaska Native peoples, at 56.4 percent.

The Northwest Arctic Borough population consisted of 45 percent of the Alaskan Arctic population (**Figure C-85**). The city of Kotzebue is the main population center within the Northwest Arctic Borough, and makes up 43 percent of the total borough population. An estimated 67.5 percent of Kotzebue's population is Alaska Native, the lowest percentage within the borough.

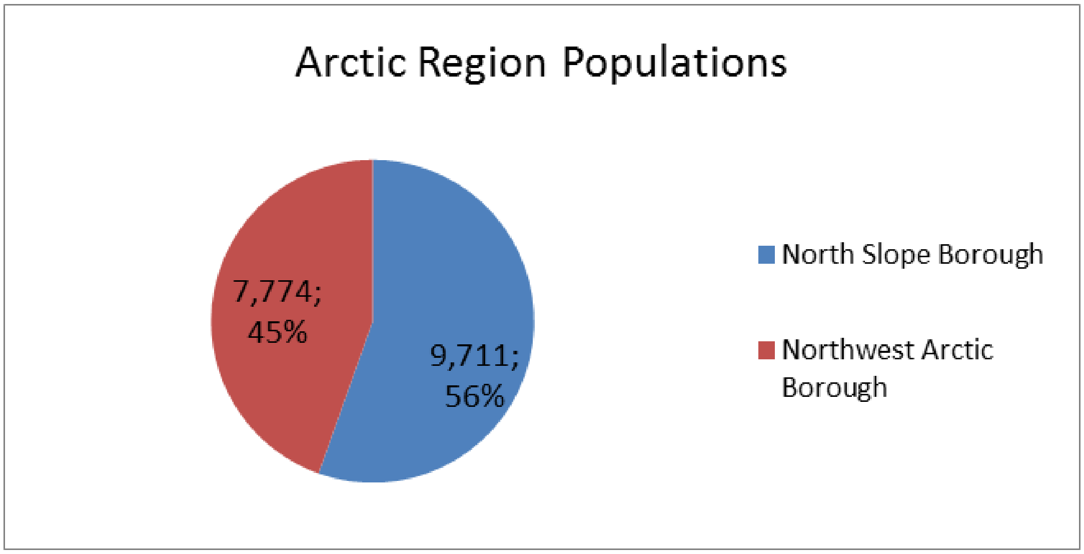


Figure C-85. Arctic Region Populations.

According to projections by the State of Alaska, the NSB is not expected to increase in population over the next 30 years, as outlined in **Table C-45** (ADLWD, 2014**)**. However, individual comprehensive plans that have been adopted by the NSB include projections if OCS exploration continues and oil and gas development occurs.[1] Not all NSB communities are discussed due to the varying state of development for respective comprehensive plans.

Table C-45. North Slope Borough Population Projections (From: ADLWD, 2014).

2012	2017	2022	2027	2032	2037	2042	2012 to 2042	
							Percent Change	Growth Rate
9,727	9,638	9,544	9,465	9,460	9,563	9,757	0%	0.00%

Barrow

According to the NSB 2010 Census, the population of Barrow was 4,974 people (NSB, 2015). The Barrow Comprehensive Plan indicates that accurate population projections should be tied to the NSB's

[1] The NSB Comprehensive Plan was last updated in 2005 and does not provide projections beyond 2020, numbers that have already been exceeded.

operating budget, which can affect in and out migration greatly. The Barrow Comprehensive Plan estimates that with oil and gas development, the Barrow population could be 7,400 people by 2035. Without oil and gas development, the plan estimates that Barrow will have approximately 6,379 residents in 2035 (NSB Department of Planning & Community Services, 2015a).

Wainwright

The NSB 2010 Census indicates the population of Wainwright was 546 people (NSB, 2015). Like the Barrow Comprehensive Plan, the 2014 Wainwright Comprehensive Plan considers the potential impact of oil and gas development in the Chukchi Sea on the number of people residing in the community. A population projection for 2035 without oil and gas development is 670 people, and if there is significant oil and gas development, the number increases to 739 people (Umiaq and Olgoonik Development LLC, 2014).

Kaktovik

The NSB 2010 Census indicated that the population in 2010 was 308 people (NSB, 2015). A comprehensive plan for Kaktovik was adopted in 2015. A high growth scenario of 3 percent with oil and gas development could result in 546 people residing in Kaktovik in 2030; a moderate growth rate of 0.5 percent would result in a population of 348 people (NSB Department of Planning & Community Services, 2015b).

Northwest Arctic Borough

According to projections by the State of Alaska, the Northwest Arctic Borough is expected to increase in population over the next 30 years, as outlined in **Table C-46**. The median household income for the NSB between 2009 and 2013 was $80,761, with 10.3 percent of the population living below the poverty level (U.S. Census Bureau, 2015). The non-seasonally adjusted unemployment rate for the NSB in July 2015 was 5.8 percent (ADLWD, 2015b), in line with unemployment rates over the past decade but substantially lower than what the NSB experienced during the early 2000s.

Table C-46. Northwest Arctic Borough Population Projections (From: NANA Regional Corporation, 2013).

2012	2017	2022	2027	2032	2037	2042	2012 - 2042	
							Percent Change	Growth Rate
7,716	8,032	8,333	8,625	8,949	9,369	9,926	29%	0.80%

11.1.1.2. Employment, Unemployment, and Earnings

Current oil and gas activities on the OCS of the Beaufort and Chukchi Seas contribute to the economies of the NSB and the State of Alaska. Prudhoe Bay/Deadhorse is the main hub for oil and gas development activities occurring within the North Slope of Alaska. Despite North Slope oil and gas activity levels and the development of the area’s petroleum reserves beginning in the 1970s, very few NSB and Northwest Arctic Borough residents have been or currently are employed by the oil and gas industry in and near Prudhoe Bay. Only approximately 1 percent of the workforce resides in the NSB, and thus contributes to its economy.

Table C-47 provides the population, income, and poverty status of various communities in the Arctic region from 2009 to 2013.

Table C-47. Arctic Region Community Population, Income, and Poverty Status (2009 to 2013) (From: U.S. Census Bureau, 2015).

Community	Total Residents	Median Household Income	Per Capita Income	Percent of Individuals Living in Poverty
State of Alaska	720,316	$70,760	$32,651	9.9%
North Slope Borough	9,484	$80,761	$46,457	10.3%
Northwest Arctic Borough	7,624	$61,607	$21,461	22.0%

11.1.1.3. Employment by Industry

In 2013, the largest employment sector in the Arctic Region was government departments and agencies, which accounted for a workforce of 2,579 people, or 33.5 percent of the total employed. Fishing, hunting, and mining sectors (inclusive of oil and gas activities), employed 1,658 employees or 21.5 percent of the employed Arctic population (**Table C-48**).

Within the Northwest Arctic Borough, which borders the Chukchi Sea, transportation services as well as oil and mineral exploration and development are the focus of economic activity. The Red Dog Mine, jointly run by the Cominco Corporation and NANA Development Corporation, is the largest zinc mine in the world and the largest economic project in the region.

Table C-48. Arctic Region Labor Force, Unemployment, Earnings, and Employment by Industrial Sector (From: U.S. Census Bureau, 2015).

Employment	North Slope Borough	Northwest Arctic Borough	Arctic Region Total
Labor Force*			
Total	**7,387**	**5,200**	**12,587**
Employed	5,217	2,489	7,706
Unemployment Rate	9.6	17.0	26.6
Employment by Industrial Sector			
Agriculture, forestry, fishing and hunting, and mining (inclusive of oil and gas activities)	1,403	255	1,658
Construction	463	180	643
Manufacturing	48	5	53
Wholesale trade	72	24	96
Retail trade	416	209	625
Transportation and warehousing and utilities	308	275	583
Finance, insurance, and real estate services	138	68	206
Government workers	1,596	983	2,579
Armed forces	31	0	31

* Labor force is considered the population of 16 years and over.

11.1.1.4. Oil and Gas Employment

An estimated 70 percent of the North Slope employment force lives outside of the immediate work area in locations such as south-central Alaska (i.e., MoA, Mat-Su Borough, and KPB), the city of Fairbanks, and the contiguous 48 states. Employment statistics typically are reported by place of residence, meaning oil and gas employment for the Arctic region is relatively small. Data for employment by place of work show that there were 2,000 oil and gas workers residing in the Arctic region in 2014, all located in the NSB. Of these workers, 5 were employed directly in oil and gas extraction activities, pipeline, and refinery activities; 70 were employed in support activities; and 1,925 were employed in other indirect work (AOGA, 2014).

According to the Alaska Department of Commerce, Community and Economic Development (ADCCD), oil and gas property tax revenues for the NSB have exceeded $180 million per year since 2000. In 2013, NSB oil and gas tax revenue resulted in $43,959 per capita (USDOI, BOEM, 2014). Alaska's tax base is composed primarily of oil and gas revenues.

11.1.2. Cook Inlet Planning Area

11.1.2.1. Community Population and Income

Between 2009 and 2013, 66 percent of the Upper Cook Inlet Region's total population lived in the MoA (**Figure C-85**). The Anchorage Economic Development Corporation (AEDC) in its 2015 Anchorage Economic Forecast report indicated that Anchorage's population is projected to increase by 0.5 percent from 2014 records, to an estimated 302,000 residents. Median household income in Anchorage between 2009 and 2013 was the highest in the region (at $77,454) and above the state average (**Table C-49**). The MoA has a diverse racial and ethnic population base; 99 different languages are spoken by students in the Anchorage School District (ASD) (ASD, 2014). In 2010, the City of Anchorage's Mountain View neighborhood was the most ethnically diverse neighborhood in the country (U.S. Census Bureau, 2010).

Of the total population of the Upper Cook Inlet Region, 13 percent live in the KPB (**Figure C-86**). There are 22 communities in the KPB, and only 5 have a population >3,000 residents.

Population in the Mat-Su Borough is dispersed among several small unincorporated communities. These are located throughout the borough, which is roughly the same size as West Virginia, and contributes 22 percent of the total population of Upper Cook Inlet Region (**Figure C-86**; ANTHC, 2015).

Information about population size, median household income, and poverty levels for Alaska and different parts of the Upper Cook Inlet Region are presented in **Table C-49**.

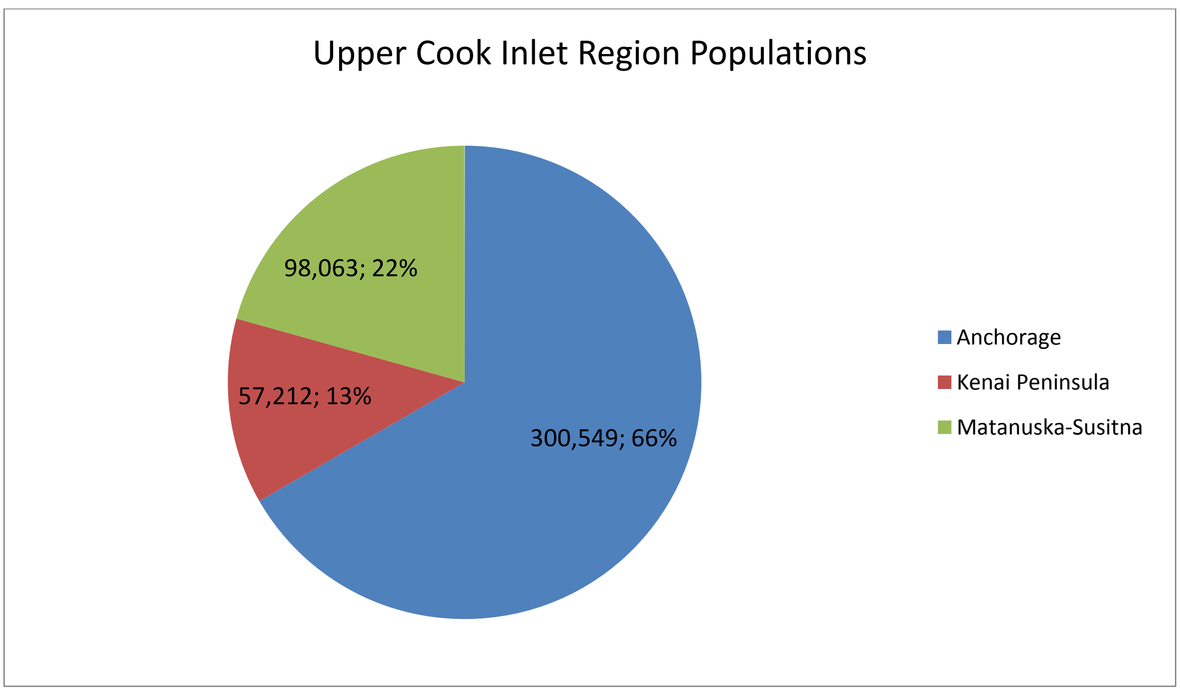


Figure C-86. Upper Cook Inlet Region Populations.

Table C-49. Upper Cook Inlet Region Community Population, Income, and Poverty Status (2009 to 2013 Average). (From: U.S. Census Bureau, 2015 and Alaska Native Tribal Health Consortium, 2014).

Community	Total Residents	Alaska Native Residents	Median Household Income	Per Capita Income	Percent of Individuals Living in Poverty
State of Alaska	720,316	147,794	70,760	32,651	9.9
Municipality of Anchorage	295,237	52,071[a]	77,454	36,214	7.9
Kenai Peninsula Borough	56,163	6,468	61,793	31,256	8.6
Matanuska-Susitna Borough	91,519	[a]	71,037	29,534	9.9

Following a median estimate means the median falls in the lowest interval of an open-ended distribution.
[a] Statistic obtained from the ANTHC 2015 databank where MoA and Mat-Su Alaska Native population details are combined.

Over the 30-year projection period included in the Population Projections 2012 – 2042 report, the most growth in Alaska is expected in Anchorage and the Mat-Su Borough. These two areas are expected to increase by a combined 140,000 people, representing a 35 percent increase over the 2012 population, to more than 530,000 in 2042. The Mat-Su Borough is anticipated to increase more than 75 percent, starting at more than 90,000 people in 2012 and reaching more than 165,000 people by 2042. The population of the KPB is expected to increase over the same 30-year period, increasing from more than 56,000 people in 2012 to more than 65,000 people in 2042, an increase of approximately 9,000 new residents.

11.1.2.2. Employment, Unemployment, and Earnings

Employment in the Upper Cook Inlet region in 2009 was concentrated in Anchorage, with 148,695 people employed, and approximately 70 percent of jobs found in the region (**Table C-50**). Unemployment rates for 2009 vary across the upper Cook Inlet region; the highest rate of unemployment in the three major population centers was 6.7 percent in Mat-Su Borough. The regional average was 18 percent. Recent projections from the AEDC for 2015 anticipates an Anchorage workforce of approximately 157,100 individuals (AEDC, 2015).

Table C-50. Upper Cook Inlet Region Labor Force, Unemployment, Earnings, and Employment by Industrial Sector (From: U.S. Census Bureau, 2015).

Employment	Anchorage	Kenai Peninsula	Matanuska-Susitna	Upper Cook Inlet Region Total
Labor Force*				
Total	**228,031**	**44,681**	**68,419**	**341,131**
Employed	148,695	25,455	39,190	**213,340**
Unemployment rate	5.1	6.2	6.7	**18**
Employment by Industrial Sector				
Agriculture, forestry, fishing and hunting, and mining (inclusive of oil and gas)	5,515	3,292	2,259	**11,066**
Construction	9,789	2,003	4,632	**16,424**
Manufacturing	2,907	1,105	990	**5,002**
Wholesale trade	3,723	444	663	**4,830**
Retail trade	16,484	2,950	4,491	**23,925**
Transportation and warehousing and utilities	11,676	1,561	2,683	**15,920**
Finance, insurance, and real estate services	7,965	836	1,182	**9,983**
Government workers	32,618	4,735	8,608	**45,961**
Armed forces	8,744	121	378	**9,243**

* Labor force is considered the population of 16 years and older.

11.1.2.3. Employment by Industry

Jobs available in the MoA are the most diverse in the State of Alaska, with government workers making up 19 percent of the workforce (**Table C-50**). Employment in manufacturing, agriculture, forestry, fishing, hunting, and mining was greater in the KPB than Mat-Su Borough, but employment numbers can fluctuate seasonally in response to recreational activities. For example, during fishing season, many temporary and seasonally focused employment opportunities are afforded. According to the ADLWD, in 2013, the transportation and utilities industry accounted for 19.1 percent of total employment, education and health services accounted for 15.2 percent, natural resources and mining accounted for 12.1 percent, and leisure/hospitality accounted for 10.5 percent. The main sources of revenue for the KPB is from real estate and personal property taxes, sales taxes, and oil and gas property taxes, which accounted for an estimated $7,800,432 in 2014 (ADLWD, 2014).

11.1.2.4. Oil and Gas Employment

Alaska’s economy heavily depends on the oil and gas industry. In 2014, oil and gas industry employment in the upper Cook Inlet region supported approximately 41,000 workers, with approximately 3,765 employed directly in oil and gas extraction activities, including pipeline and refinery activities (AOGA, 2014). The highest level of oil and gas sector employment was in the city of Anchorage with an estimated 31,000 direct, indirect, and induced jobs (AEDC, 2015). In the oil and gas sector, the KPB had a workforce of approximately 6,000 and the Mat-Su Borough had a workforce of approximately 4,000.

11.2. GULF OF MEXICO PROGRAM AREA

11.2.1. Western Planning Area

Offshore waters of the Western Planning Area are adjacent to the coast of Texas (Figure 2.1-2 in the Programmatic EIS), which extends 591 km (367 mi) from the Texas-Mexico border to the Louisiana. There are 18 counties that front on the Gulf of Mexico.

11.2.1.1. Community Population

Since 1970, all counties adjacent to the Western Planning Area experienced growth. According to the 2010 Census, >6 million resided on the coast of Texas, the only state with a coastline in the Western Planning Area (**Table C-51**; U.S. Census Bureau, 2010). Since 2010, the population has increased by 110,000 people.

Table C-51. Population Trends in Counties Adjacent to the Western Planning Area.

State	Population					
	1970	1980	1990	2000	2010	2013 Estimate
Counties Adjacent to the Western Planning Area	2,953,835	3,878,849	4,395,001	5,211,014	6,121,490	6,234,703

Sixty-seven percent of the population resides in the Houston area (Harris County). Corpus Christi, Galveston, Beaumont, and Brownsville are smaller urban centers in Houston County. There are several counties that are quite rural and have had minimal growth over the years (i.e., Kenedy and Refugio Counties).

Minorities make up nearly one-third of the population, and >40 percent of the population is Hispanic (Hispanic or Latino orgin is considered an ethnicity and not a race). Eighty-five percent of the minority population is concentrated in the Houston area while the Hispanic population is more prevalent in counties near the Mexico border.

11.2.1.2. Employment and Unemployment

There are 4,212,482 people in the labor force in counties adjacent to the Western Planning Area; of these, approximately 94 percent (3,959,255) are employed and approximately 6 percent are unemployed (**Table C-52**; U.S. Census Factfinder, 2013). Seventy percent of the employed labor force works in the Houston area. Unemployment rates exceed 9 percent in Cameron, Jefferson, Orange, and Willacy Counties.

Employment is widely distributed across the industrial sector (**Table C-53**). In most counties, wholesale and retail trade is the leading employment sector, followed by healthcare, education, and professional service sectors. Oil and gas exploration activities are more important in Texas than in most areas of the U.S., employing more than 70,000 people (U.S. Census Bureau, 2015).

Table C-52. Employment Levels in Counties Adjacent to the Western Planning Area (From: U.S. Department of Labor, Local Area Unemployment Statistics, 2014).

State	Labor Force	Employed	Unemployed	Unemployment Rate
Counties Adjacent to the Western Planning Area	4,212,482	3,959,255	253,227	5.9%

Table C-53. Employment by Industrial Sector in Counties Adjacent to the Western Planning Area (From: U.S. Census Bureau, 2015).

Sector	Total Number of People Employed
Agriculture, forestry and fishing	13,973
Mining, oil and gas exploration	70,836
Construction	263,408
Manufacturing	297,783
Wholesale and retail trade	405,614
Transportation and warehousing	139,176
Utilities	28,763
Information	39,928
Finance, insurance, and real estate	155,289
Professional, scientific, and management, and administrative and waste management services	333,532
Educational services	262,018
Health care and social assistance	326,525
Art, entertainment, and recreation, and accommodation and food services	238,831
Other services, except public administration	161,201
Public administration	98,910
Total	**2,835,787**

11.2.1.3. Economy

Key industrial sectors serve as major economic drivers. Sectors such as manufacturing, mining, oil and gas exploration, and recreation/tourism create jobs that support retail and professional services. In Texas there are >1,500 establishments working in mining, oil and gas exploration (**Table C-54**), with an annual payroll in excess of $8 billion. Tourism-related sectors, including arts, entertainment, and recreation, as well as accommodations and food services generate an annual revenue of nearly $5 billion (**Table C-54**).

Poverty can drain the economic vitality of a region. Approximately 19 percent of people living in U.S. counties adjacent to the Western Planning Area live below the poverty line (**Table C-55**). Texas has the highest poverty rate among its neighboring states bordering the Gulf of Mexico.

Table C-54. Economic Data for Counties Adjacent to the Western Planning Area (From: U.S. Census Bureau, 2013).

State	Number of Mining, Oil and Gas Exploration Establishments	Annual Payroll (in thousands)			
		Mining, Oil and Gas Exploration Sector	Accommodation and Food Services Sector	Arts, Entertainment, and Recreation Sector	Total for All Sectors
Texas	1,512	$8,079,472	$4,165,589	$965,989	$148,931,887

Table C-55. Population and Poverty Levels in Counties Adjacent to the Western Planning Area (From: U.S. Census Bureau, 2015).

State	Total Population	Population below Poverty	Percent in Poverty
Texas	6,228,887	1,205,178	19.3%

11.2.2. Central Planning Area

Offshore waters of the Central Planning Area are adjacent to the Louisiana, Mississippi, and Alabama coastlines. The Gulf of Mexico boundary extends 795 km (494 mi) from the Texas-Louisiana border to the Alabama-Florida border (Figure 2.1-2 in the Programmatic EIS). Within the Central Planning Area, 21 parishes in Louisiana, 2 counties in Alabama, and 3 counties in Mississippi border the Gulf of Mexico.

11.2.2.1. Population Characteristics

Between 1970 and 2010, the counties adjacent to the Central Planning Area experienced a nearly 50 percent growth in population (**Table C-56**). According to the 2010 Census, 3,215,022 people resided in the shoreline counties of Alabama, Mississippi, and Louisiana. By 2013, the population increased by 44,000 people (U.S. Census Bureau, 2015).

Population is not uniformly distributed across the three states. The Greater New Orleans Region (GNOR) is the major population center. With seven parishes, the GNOR has a population of nearly 1,300,000. Mobile, Alabama is another major population hub, approaching 200,000 people.

In counties adjacent to the Central Planning Area, the minority population constitutes 30 percent of the total population. The minority population constitutes >60 percent of people in New Orleans (city) and 53.5 percent of people in Mobile. The Hispanic population makes up a much smaller segment of the population (5.1 percent) (Hispanic or Latino origin is considered an ethnicity and not a race).

Table C-56. Population Trends in Counties Adjacent to the Central Planning Area (From: U.S. Census Bureau, 2015).

State	Population (in thousands)					
	1970	1980	1990	2000	2010	Estimated 2013
Alabama	376,690	443,536	476,923	540,258	595,257	609,619
Louisiana	1,827,052	2,119,716	2,135,836	2,280,779	2,249,063	2,274,304
Mississippi	39,944	300,217	312,368	363,988	370,702	375,259
Total	**2,243,686**	**2,863,469**	**2,925,127**	**3,185,025**	**3,215,022**	**3,259,182**

11.2.2.2. Employment and Unemployment

According to U.S. Department of Labor, there are 1,373,789 people in the labor force in the counties adjacent to the Central Planning Area, with 5.9 percent unemployed (**Table C-57**). Unemployment varies between states adjacent to the Central Planning Area. Unemployment rates in Alabama and Mississippi are approximately 2 percent higher than in Louisiana.

The employed work in a wide variety of sectors (**Table C-58**). Nearly 15 percent of the labor force is employed in the wholesale and retail trade sector. Other sectors employing substantial numbers of workers include health care, education, and professional services. Approximately 10 percent of the labor force works in areas that focus on tourism and recreation. Approximately 34,000 people in the counties adjacent to the Central Planning Area work in activities related to mining, oil and gas exploration, primarily in Louisiana.

Table C-57. Employment Levels in Counties Adjacent to the Central Planning Area (From: U.S. Department of Labor, 2014).

State	Labor Force	Employed	Unemployed	Unemployment Rate
Alabama	269,871	247,262	22,609	8.4%
Louisiana	1,076,718	1,022,700	54,018	5.0%
Mississippi	162,936	149,609	13,327	8.2%
Total	**1,509,525**	**1,419,571**	**89,954**	**5.9%**

Table C-58. Employment by Industrial Sector in Counties Adjacent to the Central Planning Area (From: U.S. Census Bureau, 2015).

Sector	Alabama	Louisiana	Mississippi	Total
Agriculture, forestry and fishing	2,536	9,475	873	12,884
Mining, oil and gas exploration	1,279	31,221	1,282	33,782
Construction	19,339	88,920	12,687	120,946
Manufacturing	26,236	88,649	18,375	133,260
Wholesale and retail trade	41,263	141,683	22,371	205,317
Transportation and warehousing	10,733	44,928	5,777	61,438
Utilities	3,054	9,898	1,766	14,718
Information	4,015	14,249	2,162	20,426
Finance, insurance, and real estate	14,249	52,958	8,046	75,253
Professional, scientific, and management, and administrative and waste management services	24,556	91,636	11,317	127,509
Educational services	21,438	82,880	11,261	115,579
Health care and social assistance	35,448	121,740	19,311	176,499
Art, entertainment, and recreation, and accommodation and food services	24,188	95,171	17,245	136,604
Other services, except public administration	12,933	48,570	7,305	68,808
Public administration	10,380	48,607	11,779	70,766
Total	**251,647**	**970,585**	**151,557**	**1,373,789**

11.2.2.3. Economy

Key industrial sectors drive economies in states along the Central Planning Area. Sectors such as manufacturing, mining, oil and gas exploration, and recreation/tourism create jobs that support retail and professional services. Within the states adjacent to the Program Area there are nearly 600 businesses working in mining, gas and oil exploration (**Table C-59**). The annual payroll for this sector is in excess of $1.6 billion, providing income to >34,000 people. Sectors related to tourism, including arts, entertainment, and recreation as well as accommodations and food services, generate nearly $2.8 billion of annual revenue. Sectors related to tourism provide jobs for nearly 120,000 people. All three states have poverty rates higher than the official national 2013 poverty rate of 14.5 percent (**Table C-60**).

Table C-59. Economic Data for Counties Adjacent to the Central Planning Area (From: U.S. Census Bureau, 2015).

State	Number of Mining, Oil and Gas Exploration Establishments	Annual Payroll (in thousands)			
		Mining, Oil and Gas Exploration Sector	Total for all Sectors	Arts, Entertainment, and Recreation Sector	Accommodation and Food Services Sector
Alabama	26	$22,662	$7,453,127	$41,360	$360,446
Louisiana	568	$1,595,972	$38,239,666	$285,757	$1,539,096
Mississippi	4	X	$5,052,063	$84,609	$495,431
Total	**598**	**$1,618,634**	**$50,744,856**	**$411,726**	**$2,394,973**

X = Withheld to avoid disclosing proprietary data for individual companies; data are included in higher level totals.

Table C-60. Population and Poverty Levels in Counties Adjacent to the Central Planning Area (From: U.S. Census Bureau, 2015).

State	Total Population	Population below Poverty	Percent in Poverty
Alabama	592,653	107,718	18.2%
Louisiana	1,874,467	350,027	18.7%
Mississippi	371,792	71,225	19.2%
Total	**2,838,912**	**528,970**	**18.6%**

11.3. Atlantic Program Area

11.3.1. Mid-Atlantic Planning Area

Offshore waters of the Mid-Atlantic Planning Area are adjacent to 665 km (413 mi) of North Carolina and Virginia coastline (Figure 2.1-3 in the Programmatic EIS). In addition, the 20-mi long Chesapeake Bay, including its tributaries, has 18,804 km (11,684 mi) of shoreline (Chesapeake Bay Program, 2015). There are 29 counties and 11 cities in Virginia with access to the coastal shoreline. In North Carolina, 21 counties are adjacent to the Atlantic Ocean.

11.3.1.1. Population Characteristics

Significant growth in the population of shoreline counties in North Carolina and Virginia occurred between 1970 and 2010 (**Table C-61**). According to the 2010 Census, 5,887,976 resided in these counties. Since 2010, the population has grown by 85,000 people. Population centers dot the coast of North Carolina from Wilmington to New Bern to Jacksonville. In Virginia, there is a cluster of cities located near the entrance to Chesapeake Bay and in the Fairfax-Arlington area.

Table C-61. Population Trends in Counties Adjacent to the Mid-Atlantic Planning Area.

State	Population					
	1970	1980	1990	2000	2010	Estimated 2013
Virginia	2,443,314	2,852,563	3,584,589	4,173,003	4,730,951	4,802,600
North Carolina	586,582	688,808	820,926	961,682	1,157,025	1,167,948
Total	**3,029,896**	**3,541,371**	**4,405,515**	**5,134,685**	**5,887,976**	**5,970,548**

Within these mid-Atlantic shoreline communities, 30 to 40 percent of the population is classified as minority. Virginia's minority populations are concentrated in two major clusters. One is near the District of Columbia, and the other is located in the Virginia Beach-Norfolk-Newport News area, where there is significant military presence. There is a significant Hispanic presence in these two areas as well, ranging from 17 to 20 percent of the total population (Hispanic or Latino orgin is considered an ethnicity and not a race).

11.3.1.2. Employment and Unemployment

According to U.S. Department of Labor, there are 3,117,451 people in the labor force in counties adjacent to the Mid-Atlantic Planning Area; 5.7 percent of these are unemployed (**Table C-62**). Unemployment is higher in North Carolina than in Virginia. It may be that Virginia's proximity to Washington, D.C. has enabled its residents to seek federal employment. Both states have a strong military presence; Virginia has 27 military bases, and North Carolina is home to 110,000 active-duty military personnel and military presence supports a total of 540,000 jobs (North Carolina Department of Transporation [NCDOT], No date).

The employed work in a wide variety of sectors (**Table C-63**). In most shoreline counties, the largest proportion of employed work in the wholesale and retail trade sector followed closely by the health care, education, and professional services sectors. Mining/oil and gas extraction is nearly nonexistent, providing the fewest jobs. The tourism industry has a substantial presence in Virginia and North Carolina, where approximately 10 percent of the labor force has work that focuses on tourism and recreation.

Table C-62. Employment Levels Counties Adjacent to the Mid-Atlantic Planning Area (From: U.S. Department of Labor, 2014).

State	Labor Force	Employed	Unemployed	Unemployment Rate
North Carolina	516,146	475,945	40,201	7.8%
Virginia	2,601,305	2,463,079	138,226	5.3%
Total	**3,117,451**	**2,939,024**	**178,427**	**5.7%**

Table C-63. Employment by Industrial Sector in Counties Adjacent to the Mid-Atlantic Planning Area (From: U.S. Census Bureau, 2015).

Sector	North Carolina	Virginia	Total
Agriculture, forestry and fishing	8,581	8,957	17,538
Mining, oil and gas exploration	1,306	1,987	3,293
Construction	37,516	150,614	188,130
Manufacturing	39,996	139,309	179,305
Wholesale and retail trade	69,823	288,108	357,931
Transportation and warehousing	14,987	75,996	90,983
Utilities	4,983	15,983	20,966
Information	8,129	54,904	63,033
Finance, insurance, and real estate	18,723	166,685	185,408

Sector	North Carolina	Virginia	Total
Professional, scientific, and management, and administrative and waste management services	42,769	401,099	443,868
Educational services	45,425	209,253	254,678
Health care and social assistance	71,741	264,714	336,455
Art, entertainment, and recreation, and accommodation and food services	52,682	202,662	255,344
Other services, except public administration	24,826	129,532	154,358
Public Administration	33,660	270,671	304,331
Total	**475,147**	**2,380,474**	**2,855,621**

11.3.1.3. Economy

In the coastal counties adjacent to the Mid-Atlantic Planning Area, the professional service sector provides 16.8 percent of all jobs. Wholesale and retail trade, the dominant employment sector in most areas, provides 12 percent of jobs in these coastal counties. In North Carolina, the largest employment sector is health care and social assistance, providing jobs for 14.8 percent of the employed, with the wholesale and retail sales sector accounting for 14.4 percent of all jobs. There are few oil and gas exploration service sector jobs in either state (**Table C-64**). Tourism is one of the key economic drivers in both states. For people in many counties in northern Virginia, a large portion of jobs are linked to federal employment.

Poverty rates for Virginia are lower than the official national 2013 poverty rate of 14.5 percent, but the rate for North Caroline is greater (17.5 percent) (**Table C-65)**. A study by Mitchell (2012) identified the following four key variables affecting poverty rates:

- percent of the population in the labor force;
- percent of adults who had not completed high school
- percent labor force participation (percent of labor force able to find employment); and
- percent of the population in the manufacturing industry.

Table C-64. Economic Data for the Counties Adjacent to the Mid-Atlantic Planning Area (From: U.S. Census Bureau, 2013).

State	Number of Mining/Oil and Gas Exploration Establishments	Annual Payroll (in thousands)			
		Mining/Oil and Gas Exploration Services Sector	Arts, Entertainment, and Recreation Sector	Accommodation and Food Services Sector	Total for All Sectors
Virginia	49	$13,197	$693,564	$3,463,400	$103,428,851
North Carolina	X	X	$104,343	$728,188	$10,218,218
Total	**49**	**$13,197**	**$797,907**	**$4,191,588**	**$113,647,069**

X = Withheld to avoid disclosing propriatriy data for individual companies.

Table C-65. Population and Poverty Levels in Counties Adjacent to the Mid Atlantic Planning Area (From: U.S. Census Bureau, 2015).

State	Total Population	Population below Poverty	Percent in Poverty
North Carolina	1,125,065	201,899	17.9%
Virginia	4,691,003	417,133	8.89%
Total	**5,816,068**	**619,032**	**10.64%**

11.3.2. South Atlantic Planning Area

The offshore waters of the South Atlantic Planning Area are adjacent to Georgia and South Carolina (Figure 2.1-3 in the Programmatic EIS). The 462-km (287-mi) coastline extends from the Florida-Georgia border to the South Carolina-North Carolina border. There are nine counties in Georgia and eight counties in South Carolina adjacent to the Atlantic Ocean.

11.3.2.1. Population Characteristics

Between 1970 and 2010, the population of counties along the coast nearly doubled. According to the 2010 Census (U.S. Census Bureau, 2015), 1,805,015 people lived in counties adjacent to the South Atlantic Planning Area. Estimates suggest that between 2010 and 2013, 98,000 additional people moved into these counties (**Table C-66**). Several population centers are located in the coastal region, including Savannah (Chatham County) in Georgia and Charleston (Charleston County) in South Carolina. Other urban centers are in South Carolina's Berkeley, Dorchester, and Horry Counties, including Moncks Corner, St. George, and Myrtle Beach, respectively.

Table C-66. Population Trends in Counties Adjacent to the South Atlantic Planning Area (From: U.S. Census Bureau, 2015).

State	Population					
	1970	1980	1990	2000	2010	Estimated 2013
Georgia	310,431	363,176	428,344	490,630	563,967	584,341
South Carolina	546,138	704,145	851,710	1,002,724	1,241,048	1,318,973
Total	**856,569**	**1,067,321**	**1,280,054**	**1,493,354**	**1,805,015**	**1,903,314**

11.3.2.2. Employment and Unemployment

Employment in the South Atlantic Planning Area is concentrated primarily in urban centers. More than 726,000 people make up the labor force in the coastal counties, of which 7.5 percent are unemployed (**Table C-67**). South Carolina's statewide unemployment rate is higher than Georgia's. While there are differences in county-to-county unemployment rates, among the 17 coastal counties in the South Atlantic Planning Area, unemployment rates are comparable.

The employed work in a wide variety of sectors (**Table C-68**). In most counties, wholesale and retail trade is the leading industrial sector. The tourism sector is important to the economic health of local communities. Tourism provides employment for nearly 14 percent of the residents of counties adjacent to the South Atlantic Planning Area. More than 20 percent of the residents of Charleston and Horry Counties are employed in the tourism sector. Health care, education, and professional services sectors are also important to the overall economy. Currently, the oil and gas industry is basically nonexistent.

Table C-67. Employment Levels in Counties Adjacent to the South Atlantic Planning Area (From: U.S. Department of Labor, 2014).

State	Labor Force	Employed	Unemployed	Unemployment Rate
Georgia	259,810	239,491	20,319	7.8%
South Carolina	466,811	440,311	26,500	5.7%
Total	**726,621**	**679,802**	**46,819**	**6.4%**

Table C-68. Employment by Industrial Sector in Counties Adjacent to the South Atlantic Planning Area (From: U.S. Census Bureau, 2015).

Sector	Georgia	South Carolina	Total
Agriculture, forestry and fishing	1,876	3,510	5,386
Mining, oil and gas exploration	119	212	331
Construction	14,176	33,322	47,498
Manufacturing	19,376	40,101	59,477
Wholesale and retail trade	33,539	62,583	96,122
Transportation and warehousing	12,198	15,823	28,021
Utilities	1,540	5,400	6,940
Information	3,187	8,711	11,898
Finance, insurance, and real estate	10,751	23,614	34,365
Professional, scientific, and management, and administrative and waste management services	20,480	51,846	72,326
Educational services	20,278	37,092	57,370
Health care and social assistance	29,600	54,847	84,447
Art, entertainment, and recreation, and accommodation and food services	28,760	53,692	82,452
Other services, except public administration	11,043	21,485	32,528
Public administration	20,290	25,412	45,702
Total	**227,213**	**437,650**	**664,863**

11.3.2.3. Economy

There are few companies in the mining/oil and gas exploration services sector in coastal counties adjacent to the South Atlantic Planning Area (**Table C-69**). Based on the number of establishments, it seems that most are involved in sand and gravel mining using open pit operations to provide sand to the local government for use after winter icing or to make concrete. Manufacturing and recreation/tourism create jobs that are important economic drivers due to the multiplicative effect they have in benefitting many businesses in the community. In these coastal counties, the tourism-related sectors (arts, entertainment, and recreation, and accommodations and food services) generate an annual revenue of nearly $2.8 billion and provide jobs for nearly 120,000 people. In South Carolina's Beaufort, Charleston, and Horry Counties, a higher percentage of local revenues are generated from tourism.

In Georgia, 18.5 percent of the population lives in poverty; in South Carolina, 16.2 percent (**Table C-70**). In both states, the poverty level exceeds the national 2013 poverty rate of 14.5 percent (DeNavas-Walt and Proctor, 2014).

Table C-69. Economic Data for Counties Adjacent to the South Atlantic Planning Area (From: U.S. Census Bureau, 2013).

State	Number of Mining/Oil and Gas Exploration Establishments	Annual Payroll (in thousands)			
		Mining/Oil and Gas Exploration Services Sector	Total for All Sectors Annual	Arts, Entertainment, and Recreation Sector	Accommodation and Food Services Sector
Georgia	6	X	$6,950,926	$52,509	$504,746
South Carolina	16	X	$15,393,747	$254,765	$1,386,738
Total	**22**	**X**	**$22,344,673**	**$307,274**	**$1,891,484**

X = Withheld to avoid disclosing data for individual companies; data are included in higher level totals.

Table C-70. Population and Poverty Levels in Counties Adjacent to the South Atlantic Planning Area (From: U.S. Census Bureau, 2015).

State	Total Population	Number below Poverty	Percent in Poverty
Georgia	554,998	102,771	18.5%
South Carolina	965,317	156,631	16.2%
Total	**1,520,315**	**259,402**	**17.0%**

12.0 LAND USE AND INFRASTRUCTURE

12.1. Alaska Program Area

12.1.1. Beaufort Sea and Chukchi Sea Planning Areas

The Arctic region includes the Beaufort Sea and Chukchi Sea Planning Areas (Figure 2.1-1 in the Programmatic EIS). Only the Beaufort Sea Planning Area has a well-developed oil and gas industry infrastructure on adjacent land and in state waters.

12.1.1.1. Land Use

Land use in much of the Arctic is primarily limited to subsistence pursuits, except for oil- and gas-related activities (**Section 12.1.1.3**). There are only a few small communities located adjacent to these Planning Areas, the largest of which is the city of Barrow, with an estimated population of approximately 4,229 people. Barrow, the northernmost city in the U.S., is located 10 mi south of Point Barrow on the Chukchi Sea, and is the economic, transportation, and administrative center for the NSB. The NSB includes other coastal communities adjacent to the Beaufort Sea and Chukchi Sea Planning Areas, including Point Hope (population 674), Point Lay (189), Wainwright (556), Nuiqsut (402), and Kaktovik (239), and inland communities of Anaktuvuk Pass (324) and Atqasuk (233) (Suburban Stats, 2015). Deadhorse and Prudhoe Bay are an unincorporated oil field service community at the end of the Dalton Highway adjacent to the Beaufort Sea, with fewer than 50 permanent residents, but with up to 2,000 or more oil workers present at a given time.

Furthermore, a significant percentage of the land near the Beaufort Sea and Chukchi Sea is owned by the Federal Government, although it is located within the NSB. For instance, more than half of the NSB's land is included with the National Petroleum Reserve - Alaska (NPR-A) and the Arctic NWR. Other federally managed areas include the Gates of the Arctic National Park (managed by the NPS), the National Petroleum Reserve-Alaska (managed by the BLM), and a number of Chukchi Sea coastal headlands and islands administered by the Alaska Maritime NWR (managed by the USFWS). Other major landholders include the State of Alaska, the Arctic Slope Regional Corporation, and eight native village corporations (USDOI, BOEMRE, 2010). Each of these agencies and their respective regulations need to be considered for exploration and production activities that might affect lands or waters managed by the agencies.

12.1.1.2. Transportation

Transportation-related infrastructure is minimal, and concentrated in the Prudhoe Bay oil field area. Marine shipping to North Slope communities is by barge and by lightering cargo to shore (transferring cargo between vessels of different sizes) because of the shallow coastal waters and the lack of dredging and heavy-lift equipment. Heavy-lift cranes and protected small boat shelters are found only at Prudhoe Bay's West Dock. The communities within this region are not connected by a permanent road system. Paved and unpaved roads are generally limited to the area within communities. During the summertime, transportation between communities involves traditional methods such as foot travel, kayaks and umiaqs, along with more modern modes of transportation including airplanes, four wheelers, and boats with outboard motors. During the winter, village residents travel to other villages via snowmachine (referred to as snowmobile in the contiguous U.S.). However, the residents of the community of Nuiqsut are close enough to active oil fields that they can use winter ice roads to access Prudhoe Bay and then travel down the Dalton Highway into the interior of Alaska.

Airports and related service facilities are also limited. The North Slope Subarea Plan (State of Alaska, 2015) provides summary information and additional links for much more detailed information for all of the airports and landing strips located in the NSB.

12.1.1.3. Oil and Gas Activities and Infrastructure

Exploration activities moved offshore into the Beaufort and Chukchi Seas in the 1970s, and development and production in the nearshore Beaufort Sea began in the early 1980s. Individual oil pools have been developed together as fields that share common wells, production pads, and pipelines. As of 2007, 35 fields and satellites had been developed on the North Slope and nearshore areas of the Beaufort Sea, and were producing oil. Over time, fields also have been grouped into production units with common infrastructure such as processing facilities. Since the discovery of the Prudhoe Bay oil field, more than 17 billion bbl of oil have been produced from the North Slope, and an estimated 50 billion bbl of conventional oil remain on the North Slope and in offshore waters of the U.S. Arctic.

Oil and gas infrastructure occurs intermittently along the Arctic coast from the northeast corner of the NPR-A to the Canning River. The core of production activity occurs in an area between the Kuparuk Field and the Sagavanirktok River. The Prudhoe Bay/Kuparuk oil field infrastructure is served by nearly 483 km (300 mi) of interconnected gravel roads. These roads serve >644 km (400 mi) of pipeline routes and related processing and distribution facilities.

According to the BLM, as of 2007, oil and gas activities had resulted in the development of 202 ha (500 ac) of peat roads, 3,642 ha (9,000 ac) of gravel roads and pads, 2,428 ha (6,000 ac) of gravel mines, and 809 ha (2,000 ac) of other facilities on the North Slope. Few of these lands had been restored to their original condition.

Oil and gas exploration activities are ongoing in the northeast portion of the planning area. No permanent roads have been constructed into the NPR-A; all activities there are currently supported by ice roads. Some lands within the NPR-A have special designations, including the Teshekpuk Lake, Kasegaluk Lagoon, Colville River, and Utukok Uplands Special Areas, established in recognition of the area’s outstanding wildlife resources, including geese and other birds, caribou, bears, fish, and other animals.

In 2008, the BLM issued a Record of Decision for the northeast NPR-A making nearly 17,800 km^2 (4.4 million ac) available for oil and gas leasing, though it deferred leasing on 1,740 km^2 (430,000 ac) north and east of Teshekpuk Lake for 10 years. The decision also established performance-based stipulations and required operating procedures, which apply to oil and gas and, in some cases, to other activities (USDOI, BLM, 2008).

In 2011, lease tracts in both the NE and NW NPR-A were offered. A new Integrated Activity Plan/Environmental Impact Statement for the entire NPR-A was completed and the Record of Decision was signed in February of 2013. The BLM held annual oil and gas lease sales for the NPR-A in 2015 and offered 143 tracts comprising about 1.4 million ac. One company, ConocoPhillips Alaska, Inc., submitted six bids for the right to develop oil and gas lease tracts in the reserve.

The Prudhoe Bay/Kuparuk area is also served by the Dalton Highway. This road extends more than 644 km (400 mi) from Livengood (121 km [75 mi] north of Fairbanks) to Deadhorse. The Trans-Alaska Pipeline System (TAPS) roughly parallels much of the Dalton Highway.

There are no harbors of refuge or deepwater port facilities in this region, and virtually no aids to navigation. Less than 1 percent of charted navigationally significant Arctic waters have been surveyed with modern technology to determine depths and depict hazards to navigation. Day-to-day operations and emergency response are affected by inadequate communications infrastructure (U.S. Committee on the Marine Transportation System, 2013).

Because new facilities would be necessary to develop OCS oil and gas resources, exploration and production activities would need to be coordinated with local jurisdictions. Alaska Statutes provide certain cities and boroughs (i.e., municipalities) the authority for planning and land use regulation; as such, planning commissions and/or city councils may review projects that would impact a municipality under its jurisdiction. Comments or recommendations may be provided to the agencies undertaking the action in order to account for local needs, or if local permits are needed (Alaska Department of Commerce, 2007; Freer, 2003).

12.1.1.4. USDOD and NASA Use

The Beaufort Sea and Chukchi Sea Planning Areas are fully within the Arctic boundary as defined by the U.S. Arctic Research and Policy Act, a boundary recognized by the USDOD. National security interests in the Arctic are presented in National Security Presidential Directive 66/Homeland Security Presidential Directive 25, Arctic Region Policy. The policies contained in these directives state that national security interests include: missile defense and early warning; deployment of sea and air systems for strategic sealift, strategic deterrence, maritime presence, and maritime security operations; and ensuring freedom of the seas. As described in the 2013 National Strategy of the Arctic (USDOD, 2013), "where possible, DoD will seek innovative, low-cost, small-footprint approaches to achieve these objectives." Examples of how the USDOD will accomplish this include their participation in multilateral exercises such as the Search and Rescue Exercise (SAREX) hosted by Greenland, the COLD RESPONSE Exercise hosted by Norway, and Canada's Operation NANOOK.

Since 2012, the USCG has conducted operations and training exercises in the Arctic during the summer through a series of Operation Arctic Shield deployments in preparation for the anticipated increase of maritime activities in western Alaska and the Bering Strait. During these deployments, the USCG moves aircraft, boats and personnel to locations that serve as temporary USCG home bases for sea and air support during the seasonal surge of Arctic activities. For 2015, USCG surface asset presence in the Arctic is anticipated to consist of two light-ice capable 225-foot sea-going buoy tenders, a 282-foot medium endurance cutter, and a 378- or 418-foot high endurance or national security cutter that would provide a persistent operational presence and command and control capability in an area where the USCG lacks the permanent infrastructure of a coastal sector (USCG, 2015).

There are four active U.S. Air Force radar sites located on the coast bordering the Beaufort Sea and Chukchi Sea Planning Areas. They are all Long-Range Radar Sites (LRRSs): Cape Lisburne LRRS, Point Barrow LRRS, Oliktok LRRS, and Barter Island LRRS. Each site has restricted areas within certain facilities. Access to each is only for personnel on official business and with approval of the Commander of the U.S. Air Force's 611th Air Support Group (USDOI, BOEM, 2012).

12.1.2. Cook Inlet Planning Area

The Cook Inlet watershed covers approximately 100,000 km^2 (38,610 mi^2) of southern Alaska, east of the Aleutian Range and south of the Alaska Range (Figure 2.1-1 in the Programmatic EIS). Cook Inlet is nearly 290 km (180 mi) long, running from the Gulf of Alaska roughly north by northeast to the city of Anchorage. Cook Inlet narrows into two bodies of water at its northern reaches, Turnagain Arm and Knik Arm, where receiving waters from four major tributaries enter the Inlet: the Knik, Little Susitna, Susitna, and Matanuska Rivers. The MoA, KPB, and Mat-Su Borough in south-central Alaska, along with the Kodiak Island Borough along the southern Cook Inlet, are the predominant population centers of Alaska; with a total statewide population of 735,601. The MoA/Mat-Su Economic Region has a population of 398,612, of which 300,549 reside within the MoA. The KPB has a population of 398,612 (Alaska Department of Labor, 2014). Anchorage is the state center for scheduled aircraft and the regional center for chartered aircraft. Anchorage has a cargo facility that is served by a railroad connecting it to the interior, and the port at Seward. Anchorage is home to USDOD's Joint Base Elmendorf-Richardson (JBER) and the center of Alaska's overall road network.

12.1.2.1. Land Use

The lands surrounding the Cook Inlet Program Area (Figure 2.1-1 in the Programmatic EIS) include several large national parks, NWRs, and a National Forest, including the Lake Clark National Park and Preserve, the Katmai Park and Preserve, the Kenai Fjords National Park, the Kenai NWR, the Kodiak NWR, and the Chugach National Forest. The active volcano, Mt. Redoubt, and three other historically active volcanoes border the Cook Inlet Planning Area. The region also has numerous smaller state and municipal parks and refuges. Throughout this region, commercial, recreational, personal and subsistence use fishing and hunting occur. These activities, together with the extensive federal, state and local park systems, result in a thriving tourist industry, and year-round recreational activities (**Section 14.3.1**).

In addition to tourism and recreation, the Cook Inlet Planning Area is also economically important as the primary transportation, communication, trade, service, agricultural, and financial and administrative center of the State of Alaska. Anchorage also serves as the administrative center for not only the extensive oil and gas activities that occur in the Cook Inlet Planning Area and the surrounding lands, but also for oil and gas operations that occur throughout the state. Cook Inlet and the Kenai Peninsula area have a modern road network and are served by the Ted Stevens Anchorage International Airport, as well as numerous smaller airfields and facilities. The more remote west side of Cook Inlet is not connected to the road system, and is home to the village of Tyonek, Alaska and a number of commercial set-net fish sites as well as oil camps.

Oil- and gas-related activities in the Cook Inlet Planning Area, including drilling, development and production, reservoir depletion, and metering operations are overseen on all state lands by the Alaska Oil and Gas Conservation Commission, established under the Alaska Oil and Gas Conservation Act (AS 31). The Alaska Department of Natural Resources, Division of Oil and Gas, is responsible for leasing state lands for oil, gas and geothermal development. On federal lands, the BLM Alaska Energy Program is responsible for the administration of leasable federal minerals including oil and gas, phosphates, coal, coalbed natural gas, oil shale, and geothermal resources. The BLM reviews and approves permits and licenses from companies to explore for leasable minerals on federal lands. Currently, oil and natural gas are the only leasable minerals being produced from federal lands in Alaska. BOEM is responsible for all OCS leasing policy and program development issues for oil, gas, and other marine minerals.

Alaska has adopted several incentive programs to encourage active exploration and development of the state's oil and gas resources. The Cook Inlet Recovery Act which went into effect in 2010, provides additional tax incentives to oil and gas producers. This favorable tax climate is largely responsible for revitalization of oil and gas activity in the Cook Inlet region that has led to substantial investment and increased production of oil and gas.

12.1.2.2. Port Facilities

The Port of Anchorage is the fourth largest port in Alaska, after Valdez, Nikiski, and Kivalina, and was ranked as the 96th largest port in the U.S. in 2009 (USACE, 2010). The port serves as Alaska's regional and USDOD National Strategic Port and provides services to approximately 75 percent of the total population of Alaska, including the five military bases. To support 20 plus customers, the Port of Anchorage has three dry cargo berths and two petroleum handling facilities. In 2013, five tankers called on the Port of Anchorage, offloading 4.2 million barrels of fuel to the port from the following domestic and foreign suppliers: Tesoro, Flint Hills Resources, Crowley, and The Aircraft Service International Group. Delta Western also has completed an agreement to become the fifth petroleum supplier. In 2014, 15 fuel tankers called on the Port of Anchorage, resulting in a 59 percent increase in fuel delivered across the docks compared to 2013. Fuel arriving by tanker or barge into the city docks is offloaded on two dedicated petroleum docks.

In addition to oil tankers and barges, general cargo and dry bulk vessels and pipe and cruise ships also routinely call on the Port of Anchorage. The port generally is limited to the use of barges and small container ships because of its shallow water and extreme tide variations. The port also serves as a staging and fabrication site for modules that are shipped to the North Slope for use in oil and gas activities.

Two ports are located on the east side of Cook Inlet: (1) the Port of Homer is situated 365 km (227 mi) by road from Anchorage in Kachemak Bay and consists of a deepwater dock, a Pioneer dock which receives the state ferry, an ice plant and fish dock, and a small boat harbor and ramp; (2) a collection of special-purpose docks located in and around the town of Nikiski. The Port of Nikiski is the second largest port in Alaska, after Valdez, and was ranked as the 76th largest U.S. port in 2009 based on the port tonnage (USACE, 2010).

12.1.2.3. Oil and Gas Activities and Infrastructure

The Cook Inlet basin contains commercially significant deposits of oil and gas. Recent assessments by the USGS estimate that the Cook Inlet region contain 19 trillion cubic feet (tcf) of natural gas, 600 million barrels of oil, and 46 million barrels of natural gas liquids (USDOI, USGS, 2014). Oil and gas are produced both onshore and offshore on state lands in the region; however, there are currently no active federal leases in Cook Inlet. On state lands north of the Cook Inlet Planning Area, there are 16 active offshore production platforms, with 28 producing oil and gas fields in Cook Inlet offshore water and on the Kenai Peninsula. **Figure C-87** summarizes all Cook Inlet Oil and Gas Activity as of May 2015 (ADNR, 2015a). Oil production from these platforms peaked in FY 2005, at 20,300 barrel per day (bpd), and then declined for 5 years to a low point of 8,900 bpd in 2010. Since 2010, oil production has been on a growth trend, averaging 12,200 bpd in FY 2013 and rising to 15,800 bpd in FY 2014 (Alaska Department of Revenue, 2015). This growth is attributed to increased investment by Cook Inlet independent oil producers, most notably Hilcorp Energy and Cook Inlet Energy.

The Cook Inlet Planning Area has several hundred miles of undersea and onshore oil and gas pipelines. **Figure C-88** shows the location of these pipelines, as well as exploration and test wells, geothermal leases, and surrounding communities (ADNR, 2012).

Existing offshore and onshore Cook Inlet region crude oil production is handled through the Trading Bay production facility with nearly all of the oil going to Tesoro's Refinery located near Kenai. Crude oil is received through the Port of Nikiski Terminal Wharf, which also is used to send refined products out. Cook Inlet–produced natural gas is consumed by a variety of users: it is burned for electric power at Chugach Electric Association's Beluga power-generation plant; transported to Anchorage for local use; and exported to Asia for fertilizer. Also, a likely developing market for Cook Inlet gas is consumption in Fairbanks. In conjunction with the Interior Energy Project, the Alaska Industrial Development and Export Authority is seeking information and proposals for shipping natural gas produced in the Cook Inlet to Fairbanks.

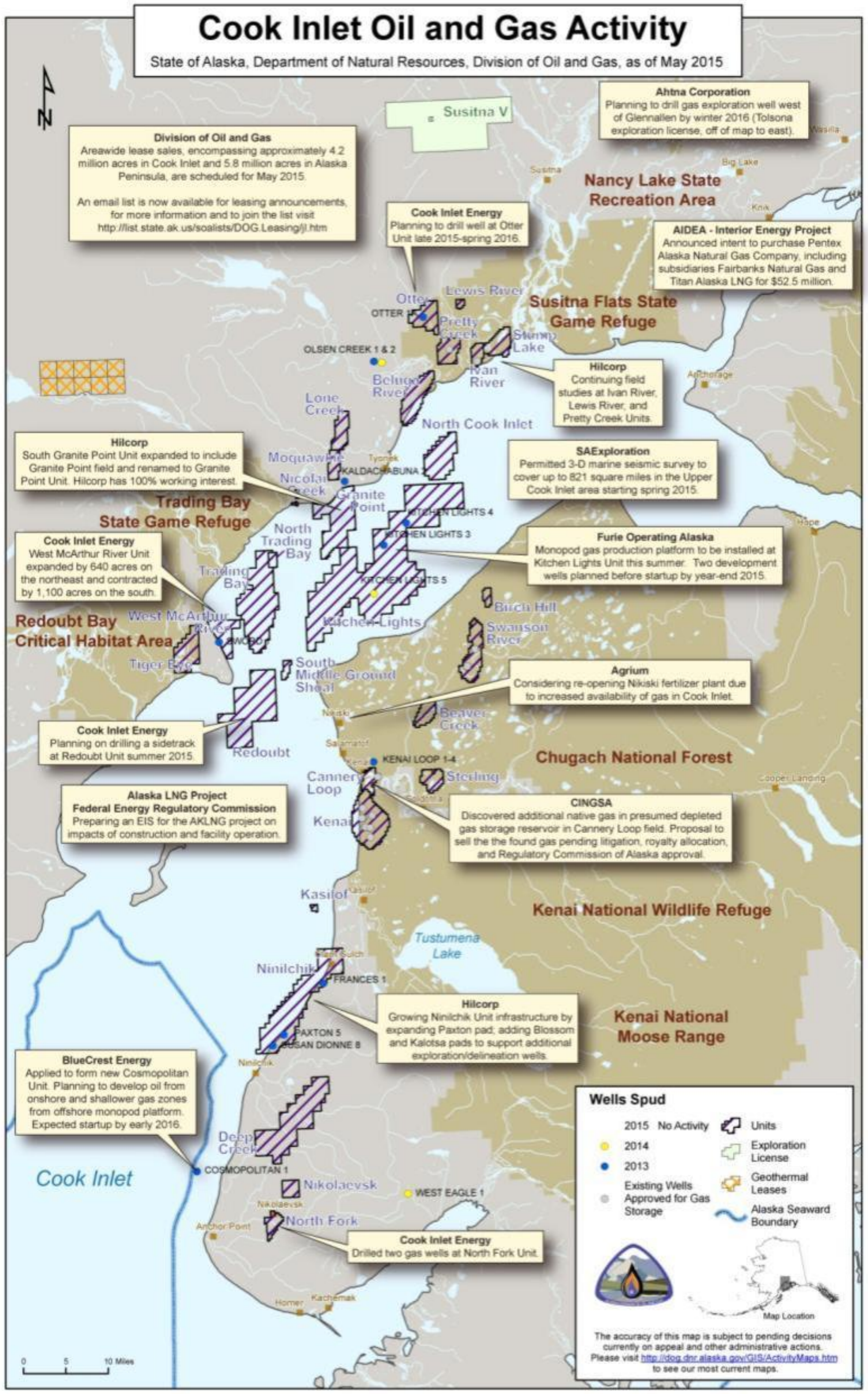


Figure C-87. Cook Inlet Oil and Gas Activities (From: ADNR, 2015a).

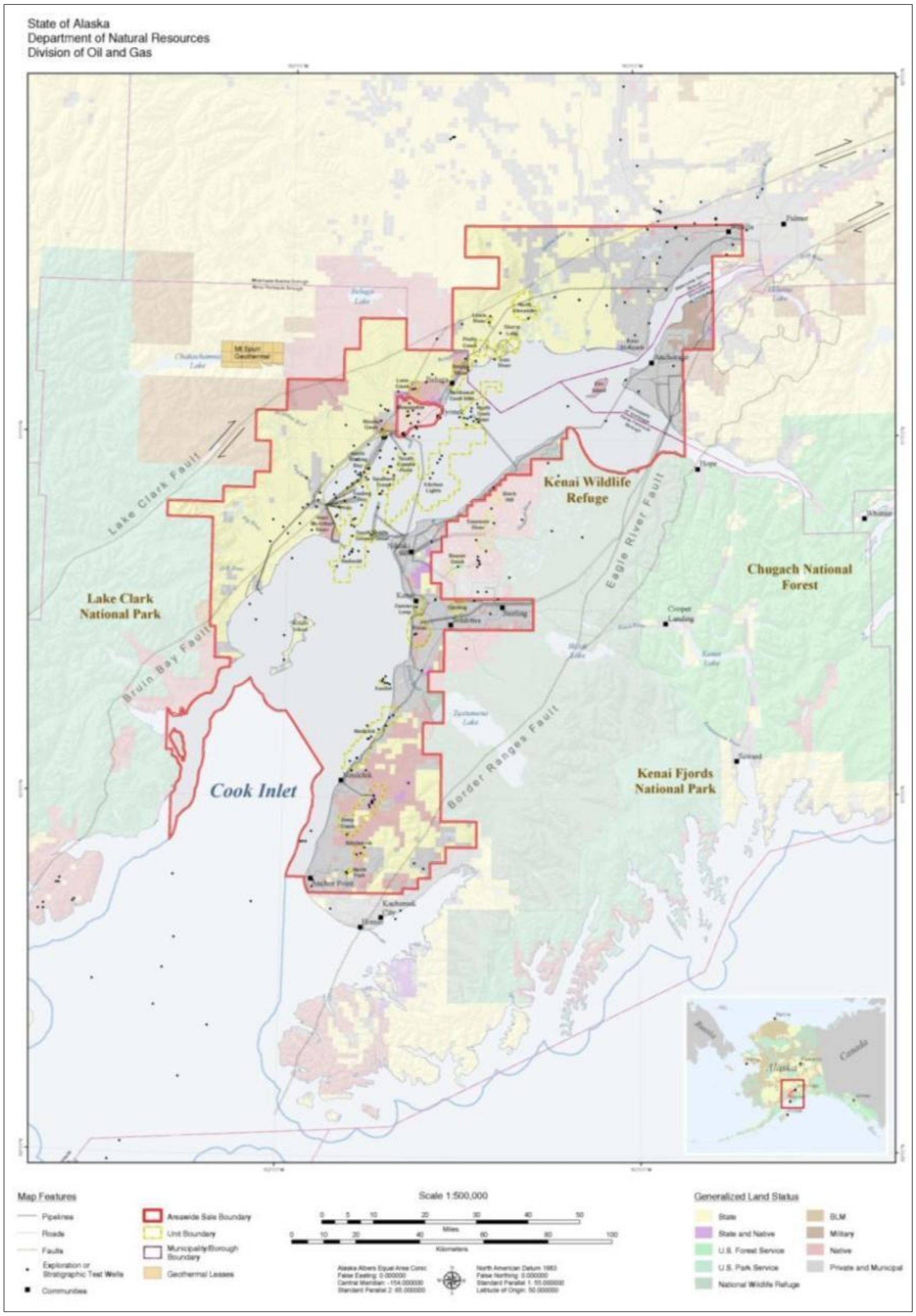


Figure C-88. Location of Pipelines, Exploration and Test Wells, Geothermal Leases, and the Surrounding Communities (From: ADNR, 2012).

Prior to 2009, crude oil production on the west side of Cook Inlet was transported by pipeline to the Drift River Tank Farm located at the terminus of the Drift River. From there, crude oil was pumped via pipeline to a ship loading facility located approximately a mile offshore, the Christy Lee Platform, where the oil was then transported by shuttle tanker across Cook Inlet to the Nikiski Terminal and the Tesoro Kenai Refinery. Early in the spring of 2009, eruptions from Mount Redoubt threatened the storage facility with flooding and mudflow and debris from the volcano, and the storage facility was temporarily closed.

Current crude oil production on the west side of Cook Inlet reaches the offloading pier in Nikiski in one of two ways: (1) some of the production flows through a 67.6-km (42-mi) long pipeline system to the Drift River storage facility, which was partially re-opened in 2012, and then to the Chisty Lee loading platform, and onto tanker. The remainder is handled by producers who pipe the crude oil directly to tankers for transport to the Tersoro Refinery. Currently, Cook Inlet Energy and the Tesoro Corporation are moving forward with plans to construct a new 8-in., 37-km (23-mi) subsea pipeline called the Trans-Foreland Pipeline System to transport western Cook Inlet crude oil production directly to the Nikiski Oil Offloading Terminal and the Tersoro Refinery. The pipeline is being designed with a capacity to handle 62,000 bpd, which is significantly higher than current western Cook Inlet oil production and will allow for future expanse in production.

The Tesoro Refinery can process up to 72,000 bpd. The refinery produces ultra-low sulfur gasoline, jet fuel, ultra-low sulfur diesel, heating oil, heavy fuel oils, propane, and asphalt. Crude oil is delivered by double-hulled tankers via the Cook Inlet and Kenai Peninsula pipelines. A 114-km (71-mi), 40,000 bpd common-carrier products pipeline transports jet fuel, gasoline, and diesel to the Port of Anchorage and the Anchorage International Airport. Wholesale delivery occurs through terminals in Kenai, Anchorage, Fairbanks, and Tesoro’s Nikiski dock (Tesoro Corporation, 2015).

Delta Western is building a new refined oil storage facility at the Port of Anchorage. The first products shipped from this facility will be methanol for use in North Slope oil fields.

Natural gas discoveries in the Cook Inlet basin in the 1950s and early 1960s, combined with a developing export market to Japan resulted in construction of the largest liquefied natural gas (LNG) plant in the world in Nikiski, on the Kenai Peninsula. A shortage of natural gas in Cook Inlet, combined with the expiration of the LNG plant’s export license in March of 2013, resulted in the plant closing after 47 years of continuous operation. Since that time, new discoveries of natural gas in the Cook Inlet Basin, together with a favorable export market, has resulted in Conoco Phillips applying for a new export license. This license was granted in April of 2014 by the U.S. Department of Energy, allowing the export of the equivalent of 40 billion cubic feet (bcf) of LNG over a 2-year period (Kenai LNG Exports/ConocoPhillips, 2015).

12.1.2.4. U. S. Department of Defense (USDOD) and NASA Use Areas

At the northern end of Cook Inlet, immediately adjacent to the City of Anchorage, the JBER comprises 84,000 ac that include $11.4 billion of infrastructure and 5,500 military and civilian personnel. The 673d Air Base Wing serves as the host command in combining installation management functions of Elmendorf Air Force Base’s 3rd Wing, and U.S. Army Garrison Fort Richardson, and consists of four groups that operate and maintain the JBER for air sovereignty, combat training, force staging and through output operations in support of worldwide contingencies. The installation hosts the headquarters for the U.S. Alaskan Command, 11th Air Force, U.S. Army Alaska, and the Alaskan North American Aerospace Defense Command Region.

There are no military or NASA use restrictions such as danger zones or restricted areas, in the waters of the Cook Inlet Planning Area (National Marine Protected Areas Center, 2008). Nearly all of the USDOD fuel requirements come by barge or tanker through the Port of Anchorage for offload, however. Generally, this fuel comes by barge or tanker from the Petro Star Valdez Refinery; however, it also can come from the U.S. West Coast by government charter or by Military Sealift Command Tanker.

The closest military danger zone to the Cook Inlet Program Area is Blying Sound, located to the east of Cook Inlet, in the Gulf of Alaska and near the entrance to Prince William Sound. The Blying Sound danger area is an air-to-air gunnery range managed by the U.S. Alaska Command and U.S. Air Force. Any practice firing that takes place in the danger area requires 7 days of advance notice to the public and at least 48 hours notice to the USCG and all mariners (Notice to Airmen).

12.2. Gulf of Mexico Program Area

The Gulf of Mexico Program Area extends from the Florida Keys westward to the southern tip of Texas, following the coastline of five states. The combined coastline totals more than 2,623 km (1,630 mi). Land use is a heterogeneous mix of urban areas, manufacturing, oil and gas activities, marine and shipping, agricultural, and recreational areas. There are 67 metropolitan and 65 rural counties adjacent to the Gulf of Mexico, and the region contains one of the five most populous U.S. cities, Houston (as of 2010; U.S. Census Bureau, 2012). Approximately 13 percent of the nation's coastal population (as of 2010; U.S. Census Bureau, 2011) and 10 of the nation's 20 largest ports by tonnage (as of 2013; USACE, 2013) are found in the Gulf of Mexico.

Given the size and unique ecological diversity of land adjacent to the Gulf of Mexico, many state and national parks and wildlife preservation areas have been established. The coastal area contains half of the wetlands in the U.S., and these are home to vital natural resources, including nesting waterfowl, water bird rookeries, sea turtles, and fisheries. These resources are supported by abundant bays, estuaries, tidal flats, barrier islands, hard and soft wood forests, and mangrove forests. Fishing, shrimping, recreation, and tourism are some of the important economic activities supported by these areas.

States adjacent to the Gulf of Mexico participate in the national Coastal Zone Management (CZM) Program and have taken various approaches to managing their coastal lands. The CZM Program is a voluntary partnership between the Federal Government and the U.S. Coastal and Great Lakes States and Territories authorized by the Coastal Zone Management Act of 1972 (CZMA) to address national coastal issues. Key elements of the national CZM Program include the following:

- Protecting natural resources;
- Managing development in high hazard areas;
- Giving development priority to coastal-dependent uses;
- Providing public access for recreation; and
- Coordinating state and federal actions.

The coastal area adjacent to the Gulf of Mexico Program Area is very diverse. Areas of special concern, including NMSs, national parks, NWRs, and MPAs, are discussed in **Section 9**. States along the Gulf of Mexico coast have authority over submerged lands to approximately 3 nmi (5.6 km), with the exception of Texas and Florida, who have jurisdiction to approximately 9 nmi (16.7 km).

12.2.1. Oil and Gas Activities and Infrastructure

Oil and gas development and production play important roles in determining land uses in many communities near the Gulf of Mexico. These are the locations from which offshore operations are staged, and where the exploration and production equipment, personnel, and supplies used for oil and gas operations on the OCS in the Gulf of Mexico originate (Louis Berger Group, Inc., 2004). The use of these facilities and trends in new facility development closely follow the level of activity in offshore drilling, with increased deepwater drilling having provided an important stimulus for increased facility use and development in recent decades. Because of the large size of the structures involved, construction and servicing of remote deepwater facilities require deeper ports than nearshore operations. There are several ports with deepwater access along the Gulf of Mexico coast, and deepwater development activities occurring around these ports. With the expansion of deepwater activities, some onshore facilities have migrated to these ports and nearby areas that have capabilities for handling deepwater vessels, which require more draft. As previously indicated, the Gulf of Mexico contains 10 of the nation's 20 largest ports by tonnage (as of 2013; USACE, 2013).

The western and central portions of the Gulf of Mexico region (offshore Texas, Louisiana, Mississippi, and Alabama) are major offshore oil and gas exploration and production areas, and most of the equipment and facilities supporting offshore Gulf of Mexico oil and gas operations are located in these areas. Only limited offshore oil activities (i.e., exploratory activities, a single major project) have occurred in the Eastern Planning Area, and there is very little infrastructure in place to support exploration and development of offshore oil and gas off the west coast of Florida. Current data indicate there are >3,531 platforms/rigs located in the Gulf of Mexico (as of 2015; USDOI, BSEE, 2015).

Oil and gas activities on the OCS are supported by onshore infrastructure industries consisting of thousands of contractors responsible for virtually every facet of the activity, including supply, maintenance, and crew bases. These contractors are hired to service production areas, provide material and manpower support, and repair and maintain facilities along the coasts. Nearly all of these support industries are found near ports.

There are hundreds of onshore facilities in the Gulf of Mexico region that support the offshore industry. Platform fabrication facilities are located along the Gulf of Mexico from the Texas-Mexico border to the Florida Panhandle, and employ large numbers of workers during periods of active development. Shipbuilding and repair facilities are located in key ports along the Gulf of Mexico coast.

Other offshore support industries are responsible for such products and services as engine and turbine construction and repair, electric generators, chains, gears, tools, pumps, compressors, and a variety of other tools. In addition, drilling muds, chemicals, and fluids are produced and transported from onshore support facilities, and these materials and other equipment are stored in warehouses near Gulf of Mexico ports. Many types of transportation vessels and helicopters are used to transport workers and materials to and from OCS platforms. Crew quarters and bases also are near ports, but some helicopter facilities are located farther inland.

12.2.2. Listed Infrastructure

Existing OCS-related infrastructure in the region includes the following:

- **Port Facilities**. Major maritime staging areas for movement between onshore industries and infrastructure and offshore leases.
- **Shipping and Marine Transportation**. Marine transportation and commercial vessel movement.
- **Platform Fabrication Yards**. Facilities in which platforms are constructed and assembled for transportation to offshore areas. Facilities can also be used for maintenance and storage.
- **Shipyards and Shipbuilding Yards.** Facilities in which ships, drilling platforms, and crew boats are constructed and maintained.
- **Support and Transport Facilities**. Facilities and services that support offshore activities. This includes repair and maintenance yards, supply bases, crew services, and heliports.
- **Pipelines.** Infrastructure that is used to transport oil and gas from offshore facilities to onshore processing sites and ultimately to end users.
- **Pipe Coating Plants and Yards**. Sites that condition and coat pipelines used to transport oil and gas from offshore production locations.
- **Natural Gas Processing Facilities and Storage Facilities**. Sites that process natural gas and separate its component parts for the market, or that store processed natural gas for use during peak periods.
- **Refineries**. Industrial facilities that process crude oil into numerous end-use and intermediate-use products.
- **Petrochemical Plants**. Industrial facilities that intensively use oil and natural gas and their associated byproducts for fuel and feedstock purposes.
- **Renewable Energy Development**. Offshore sites reserved for the development of renewable energy projects.

- **Ocean Dredged Material Disposal Sites**. Sites used for the disposal of dredged material from the maintenance dredging of commercial and military ports.
- **Waste Management Facilities**. Sites that process drilling and production wastes associated with offshore oil and gas activities.
- **Military and National Aeronautics and Space Administration (NASA) Use Areas**. Restricted sites used by the military and NASA for operations, testing, and training purposes.

Figures C-89 shows the key ports within the Gulf of Mexico and **Figure C-90** shows key oil and gas onshore and offshore infrastructure.

A short description of each type of infrastructure facility can be found below. Unless otherwise indicated, the following information is from the MMS study, *Infrastructure Fact Book, Volume I: OCS-Related Energy Infrastructure and Post-Hurricane Impact Assessment* (Dismukes, 2011); more detailed information can be found in this report.

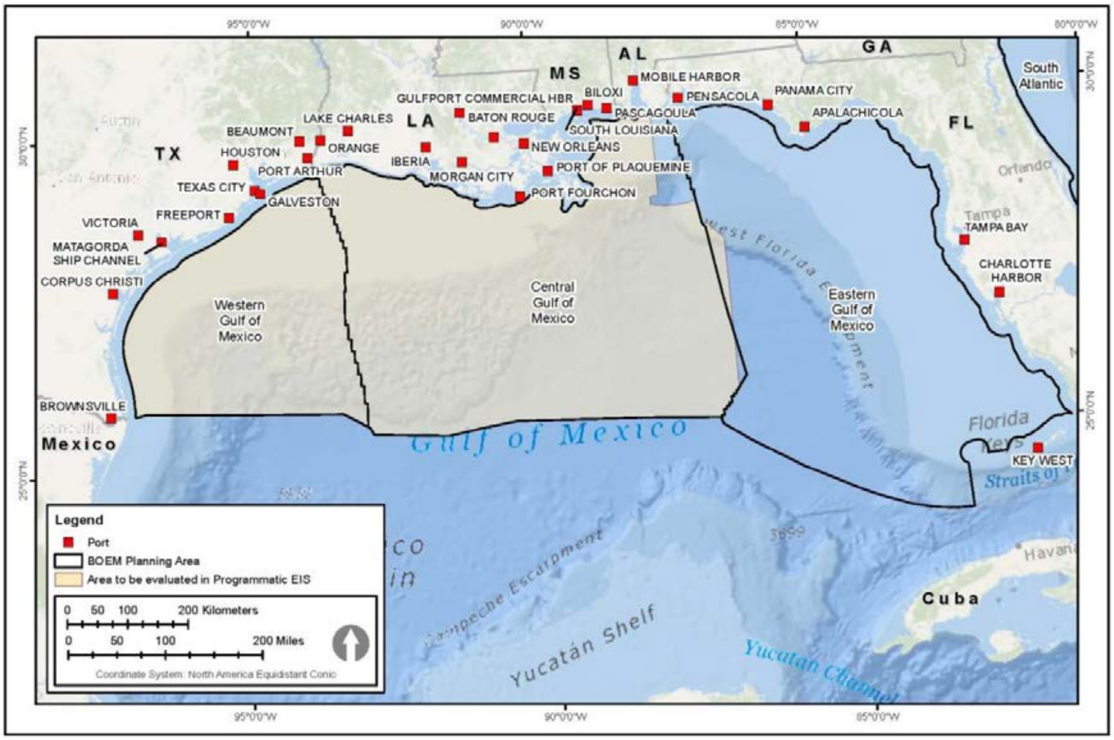


Figure C-89. Key Ports in the Gulf of Mexico.

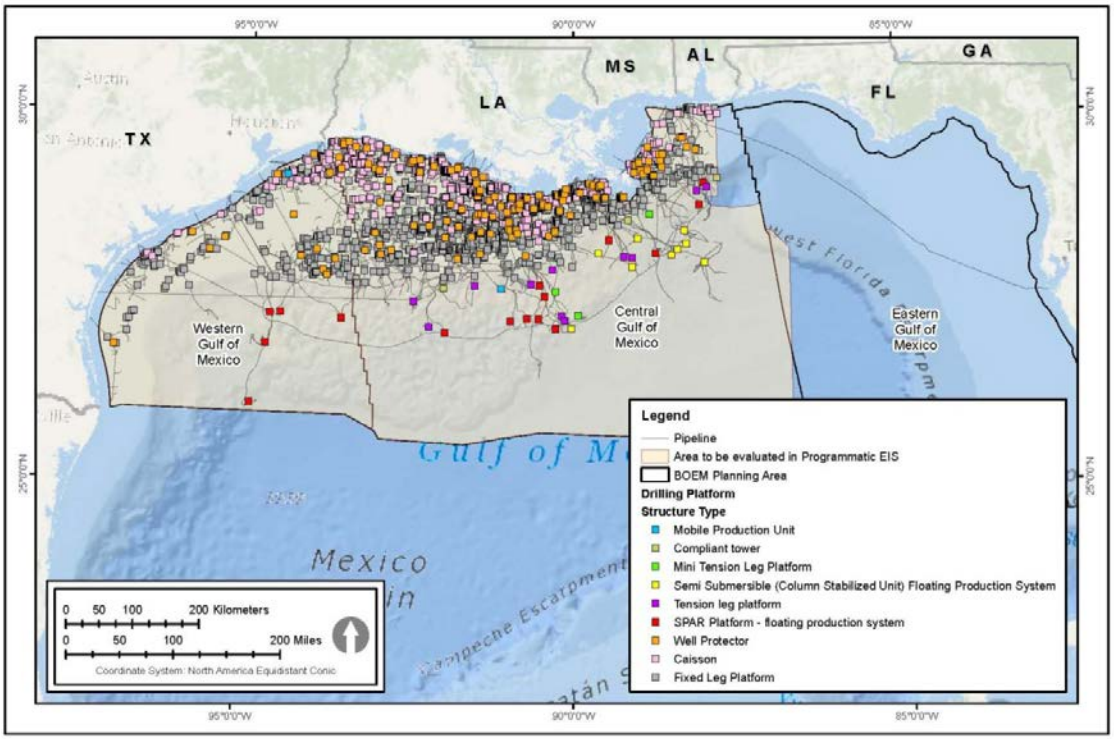


Figure C-90. Key Oil and Gas Onshore and Offshore Infrastructure in the Gulf of Mexico.

12.2.2.1. Ports

States along the Gulf of Mexico provide substantial support to service the OCS oil and gas industry. Service bases and other industries at many ports offer a variety of services and support activities to assist the industry. Personnel, supplies, and equipment must come from the land-based support industry and pass through a port to reach drilling sites. The most significant of these ports include: Port Fourchon, Port of Morgan City, and the Port of Iberia, Louisiana; and the Port of Galveston, Texas.

In addition to servicing the offshore oil and gas industry, a number of Gulf of Mexico ports are also important commercial ports. According to the USACE Waterborne Commerce Statistics Center, 10 of the top 20 U.S. ports ranked by total tons of cargo handled were in the Gulf of Mexico (as of 2013; USACE, 2013). These ports, ranked in order of tonnage handled, are as follows:

- South Louisiana, LA (ranked #1, 238.5 million tons)
- Houston, TX (ranked #2, 229.2 million tons)
- Beaumont, TX (ranked #4, 94.4 million tons)
- New Orleans, LA (ranked #7, 77.1 million tons)
- Corpus Christi, TX (ranked #8, 76.1 million tons)
- Baton Rouge, LA (ranked #9, 63.8 million tons)
- Plaquemines, LA (ranked #11, 56.8 million tons)
- Lake Charles, LA (ranked #12, 56.5 million tons)
- Mobile, AL (ranked #13, 53.9 million tons)
- Texas City, TX (ranked #14, 49.6 million tons)

In 2011, Gulf of Mexico ports accounted for 34.1 percent of U.S. vessel calls, up from 28.7 percent five years earlier, due to the large volumes of liquid and dry bulk cargoes they handled. The share of U.S. vessel calls in the Gulf of Mexico increased for six of the seven major vessel types lead by gas and tanker vessels (U.S. Department of Transportation [USDOT], 2013a). In addition, Gulf of Mexico ports include 2 of the top 25 container ports in North America in numbers of containers handled; with Houston ranked #9 with 1.8 million containers and New Orleans ranked #23 with 477 thousand containers (as of 2011; AAPA, 2012).

Gulf of Mexico ports include a wide variety of shore-side operations from intermodal transfer to manufacturing. The ports vary widely in size, ownership, and functional characteristics. Private ports operate as dedicated terminals to support the operation of an individual company. They often integrate both fabrication and offshore transport into their activities. Public ports lease space to individual business ventures and derive benefit through leases, fees charged, and jobs created. Other ports include a combination of local recreational and offshore activities.

12.2.2.2. Shipping and Marine Transportation

Eleven commercial deepwater ports are located along the Gulf of Mexico they include: Mobile, Alabama; Pascagoula, Mississippi; Port Fourchon, Lake Charles, Morgan City, Plaquemines and Venice, Louisiana; and Corpus Christi, Freeport, Galveston, and Port Arthur, Texas. Large commercial vessels (cargo ships, tankers, and container ships) use these ports to access overland rail and road routes to transport goods throughout the U.S. Between 2006 and 2011 large commercial vessel traffic increased in the Gulf of Mexico by 18.8 percent according to a U.S. Maritime Administration report on Vessel Calls at U.S. Ports (USDOT, 2013b).

Other vessels using these ports include military vessels, commercial business craft (tug boats, fishing vessels, and ferries), commercial recreational craft (cruise ships and charters for fishing, sightseeing, and diving), research vessels, and personal craft (fishing boats, houseboats, yachts and sailboats, and other pleasure craft).

The USCG designates shipping fairways and establishes traffic separation schemes that control the movement of vessels as they approach ports (33 CFR part 166). Each of the ports is serviced by a navigation channel maintained by the USACE. Traffic fairways and the buoys and beacons that serve as aids to navigation are identified on NOAA's Office of Coast Survey's navigation charts. **Figure C-91** provides a map of the Gulf of Mexico's principle ports and waterway networks.

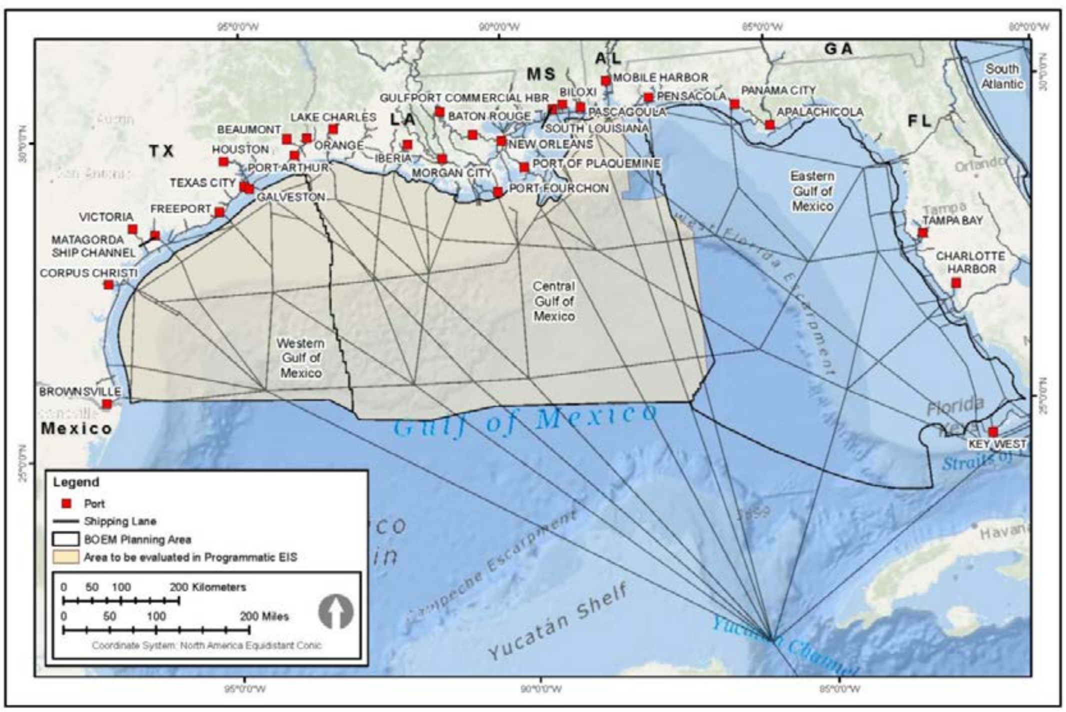


Figure C-91. Gulf of Mexico Principal Ports and Shipping Fairways.

12.2.2.3. Platform Fabrication Yards

Offshore drilling and production platforms are fabricated onshore at platform-fabrication yards and then towed to an offshore location for installation. Located along an extensive intracoastal waterway system, yet within access to the Gulf of Mexico, the industry hosts numerous specialized fabrication yards and facilities. For the most part, each yard has a specialty, whether it is the fabrication of separator or heater/treater skids, the construction of living quarters, the provision of hookup services, or the fabrication of jackets, decks and topside modules. While there are large facilities capable of handling current and next-generation deepwater structures, few facilities have complete capabilities for all facets of such a project. According to the Atlantic Communications 2006 Gulf Coast Oil Directory, there are >80 platform fabrication yards located in the Gulf of Mexico region, concentrated in Louisiana and Texas (Dismukes, 2011).

Because of the size of the fabricated product and the need to store a large quantity of materials such as metal pipes and beams, fabrication yards typically occupy large areas, ranging from just a few acres to several hundred acres. Typical fabrication yard equipment includes lifts and cranes, various types of welding equipment, rolling mills, and sandblasting machinery. Besides large open spaces required for jacket assembly, fabrication yards also have covered warehouses and shops.

12.2.2.4. Shipyards and Shipbuilding Yards

A 2007 report from USDOT indicated that only 28 private shipyards with major shipbuilding and repair bases were present in the Gulf of Mexico. Of those, there are 4 active shipbuilding yards, 5 repair yards with dry dock facilities, 12 topside repair yards, and 7 other shipyards with building positions. A private count of shipyards dated October 2014 indicated that there were 164 shipyards of all sizes located on the Gulf of Mexico coast (Marine Log, 2014). In addition to these shipyards, there are approximately 1,200 other companies in the Gulf of Mexico that build or repair other craft such as tugboats, supply boats, ferries, fishing vessels, barges, and pleasure boats (Marine Yellow Pages, 2015).

Major shipyards in the Gulf of Mexico region are located primarily in Texas and Louisiana; however, several are located in Pascagoula, Mississippi, and other sites east of the Mississippi River. Recent high demand, driven in part by the expansion of deepwater oil and gas operations, has led to the expansion of capacity by smaller shipyards, which are building more and larger vessels that are technologically more sophisticated. This expansion has been accompanied by development of new pipe and fabrication shops, dry-dock extensions, military work enhancement programs, automated steel process buildings, and expanded design programs.

The Gulf of Mexico shipyard and shipbuilding industry accounted for an estimated 38,150 jobs in 2011, including both payroll employees, self-employed workers, and both full-time and part-time workers. The vast majority of these jobs were in shipbuilding and repair, with the remainder in routine maintenance and repair conducted outside of a shipyard (USDOT, 2013c). **Table C-71** below shows the total private sector direct employment in the industry, by state, for the Gulf of Mexico in 2011.

Table C-71. Private Sector Direct Employment in the Gulf of Mexico Shipyard and Shipbuilding Industry in 2011 (From: USDOT, 2013c).

State	Private Employment	Percent of U.S. Total
Louisiana	12,970	12.1
Mississippi	10,100	9.4
Florida	5,790	5.4
Texas	5,480	5.1
Alabama	3,810	3.6
Total	**38,150**	**35.6**

Total private sector labor income in the Gulf of Mexico shipyard and shipbuilding industry, including wages and salaries and benefits as well as proprietors' income, amounted to $2.8 billion in 2011 (USDOT, 2013c). **Table C-72** below shows the total private sector direct labor income for the industry, by state, for the Gulf of Mexico in 2011. Average labor income per job was approximately $73,630 in 2011, 45 percent higher than the national average for the private sector economy ($50,786).

Table C-72. Private Sector Direct Labor Income in the Gulf of Mexico Shipyard and Shipbuilding Industry in 2011 (From: USDOT, 2013c).

State	Private Labor Income ($ Millions)	Percent of U.S. Total
Mississippi	1,087.8	13.8
Louisiana	839.0	10.6
Texas	346.9	4.4
Florida	325.9	4.1
Alabama	232.7	2.9
Total	**2,832.3**	**35.8**

12.2.2.5. Support and Transport Facilities

A variety of facilities and services support offshore activities by providing supplies, equipment repair and maintenance services, services for crews, and transportation, including boats and heliports.

The main types of vessels used in the Gulf of Mexico offshore industry include anchor handling towing supply (AHTS) vessels, offshore support vessels (OSVs), and crew boats. There is a large fleet of offshore tugs (AHTS vessels) whose sole job is to tow rigs from one location to another and to position a rig's anchors. Offshore supply vessels deliver drilling supplies such as liquid mud, dry bulk cement, fuel, drinking water, drill pipe, casing, and a variety of other supplies to drilling rigs and platforms. Crew boats transport personnel to, from, and between offshore rigs and platforms. There are a variety of other types of vessels used by the oil and gas industry, and these vessels originate in a variety of locations along the Gulf of Mexico coast at or near ports.

Helicopters are one of the primary modes of transporting personnel between service bases and offshore platforms, drilling rigs, derrick barges, and pipeline construction barges. Helicopters are routinely used for normal crew changes and at other times to transport management and special service personnel to offshore exploration and production sites. In addition, equipment and supplies are sometimes transported. For small parts needed for an emergency repair or for a costly piece of equipment, helicopter use is more economical than supply boat to transport what is needed to or from offshore quickly.

12.2.2.6. Pipelines

Locations where offshore pipelines cross the shoreline to land are referred to as pipeline landfalls. In the Gulf of Mexico region, approximately 60 percent of OCS pipelines entering state waters tie into existing pipeline systems and thus do not require pipeline landfalls. Only a small percentage of onshore pipelines in the region are a direct result of oil and gas activities on the OCS. There are >100 active OCS pipelines making landfall, resulting in approximately 200 km (124 mi) of pipelines onshore. Approximately 80 percent of the onshore length of OCS pipelines is in Louisiana, and 20 percent is in Texas. The distribution of pipelines is shown in **Figure C-90**. Offshore there are more than 40,200 km (25,000 mi) of oil and gas pipeline connecting producing areas to pipeline landfalls (USDOC, NOAA, 2012).

Inland, the pipeline network in the Gulf of Mexico's coastal states is extensive. Pipelines transport crude oil and natural gas to processing plants and refineries, natural gas from producing states in the Gulf of Mexico region to users in other states, refined petroleum products such as gasoline and diesel from refineries in the Gulf of Mexico region to markets all over the country, and chemical products.

12.2.2.7. Pipecoating Plants and Yards

Pipecoating plants are facilities where pipe surfaces are coated with metallic, inorganic, and organic materials to protect against corrosion and abrasion. These facilities generally do not manufacture or supply pipe, although some facilities are associated with mills where certain kinds of pipes are manufactured. More typically, the manufactured pipe is shipped by rail or water to pipecoating plants or their pipe yards. The coated pipe is stored at the pipe yard until it is needed offshore. It is then placed on barges or layships where the contractors weld the pipe sections together and clean and coat the newly welded joints. Finally, the pipe is laid.

Pipecoating plants in the Gulf of Mexico region are located primarily in Texas and Louisiana, with a small number of plants in the eastern states. A private count of pipecoating plant and yards in the Gulf of Mexico indicted there were approximately 55 pipecoating plants in the region as of 2012 (National Association of Pipe Coating Applicators, 2012) In recent years, pipecoating companies have been expanding capacity or building new plants to respond to increased demand from deepwater oil and gas operations.

12.2.2.8. Natural Gas Processing Plant and Storage Facilities

After raw gas is brought to the surface, either dissolved in crude oil, combined with crude oil deposits, or from separate non-oil-associated deposits, it is processed at a gas processing plant to remove impurities and to transform it into a sellable commodity. Centrally located to serve different fields, natural gas processing plants have two main purposes: (1) to remove essentially all impurities from the gas, and (2) to separate the gas into its useful components for eventual distribution to consumers. After processing, the gas is then moved into a pipeline system for transportation to an area where it is sold. Because natural gas reserves are not evenly spaced across the continent, an efficient, reliable gas transportation system is essential.

As of 2012, there were 238 gas processing plants in U.S. states bordering the Gulf of Mexico, representing 46 percent of U.S. gas processing capacity (U.S. Energy Information Administration [USEIA], 2012). More than half of the current natural gas processing plant capacity in the U.S. is located near the Gulf of Mexico's coast in Texas and Louisiana. Four of the largest capacity natural gas processing/treatment plants are found in Louisiana, while the greatest number of individual natural gas plants is located in Texas. In 2012, Texas led the U.S. in processing capacity with 164 processing plants, followed closely by Louisiana with 54 plants.

12.2.2.9. Refineries

A refinery is a complex industrial facility designed to produce various useful petroleum products from crude oil. Refineries vary in size, sophistication, and cost depending on location, the types of crude they refine, and the petroleum products they manufacture. More than 45 percent of total U.S. petroleum refining capacity is located along the coast of the Gulf of Mexico (USEIA, 2014), with 36 percent of the operable refineries located in Texas, Louisiana, Mississippi, and Alabama (USEIA, 2014). **Table C-73** provides details on the refining capacity in the Gulf of Mexico region.

The combined capacity of Texas and Louisiana represents >47 percent of total operating U.S. refining capacity (USEIA, 2014).

Table C-73. Refining Capacity in the Gulf of Mexico Region (From: USEIA, 2014).

State	Operational Refineries	Barrels per Day
Texas	27	5,174,209
Louisiana	19	3,274,520
Mississippi	3	364,000
Alabama	3	120,100
Total	**52**	**8,932,829**

12.2.2.10. Petrochemical Plants

The chemical industry converts raw materials such as oil, natural gas, air, water, metals, and minerals into more than 70,000 different products. The industrial organic chemical sector includes thousands of chemicals and hundreds of processes. Non-fuel components derived from crude oil and natural gas are known as petrochemicals. The processes of importance in petrochemical manufacturing are distillation, solvent extraction, crystallization, absorption, adsorption, cracking, reforming, alkylation, isomerization, and polymerization. Laid out like industrial parks, most petrochemical complexes include plants that manufacture any combination of primary, intermediate, and end-use products. Chemical manufacturing sites typically are chosen for their access to raw materials and to transportation routes. And, because the chemical industry is its own best customer, facilities tend to cluster near such end-users.

As of 2007, there were 56 petrochemical manufacturing establishments in the U.S., 32 of which were in Texas and Louisiana (U.S. Census Bureau, 2011). As of 2007, Texas (with 26 petrochemical manufacturing facilities) and Louisiana (with 6 petrochemical manufacturing facilities) contained more facilities than any other state. Alabama also had two petrochemical manufacturing facilities, primarily because petroleum and natural gas feedstocks are available from refineries.

12.2.2.11. Waste Management Facilities

The bulk of waste materials produced by offshore oil and gas activities include formation water (produced water), drilling muds, and cuttings. Additional waste materials include small quantities of treated domestic and sanitary waste, bilge water, ballast water, produced sands, waste oil, excess cement, and chemical products. All of these waste streams are regulated by the USEPA through discharge permits and either are released after treatment or returned to shore for disposal (USDOI, BOEM, 2015d).

The physical and chemical characters of these wastes make certain management methods preferable. The infrastructure network needed to manage the spectrum of waste generated by OCS exploration and production activities, and returned to land for management, can be divided into three categories:

(1) Transfer facilities at ports, where the waste is transferred from supply boats to another transportation mode, either barge or truck, toward a final point of disposition;
(2) Special-purpose, oil field waste management facilities, dedicated to handling particular types of oil field waste; and
(3) Generic waste management facilities, which receive waste from many American industries, with waste generated in the oil field being only a small part.

Regulations governing storage, processing, and disposal at waste management facilities vary depending on the type of waste. Waste management facilities in the Gulf of Mexico region that handle OCS oil and gas activity-related waste include transfer facilities, salt dome disposal facilities, and landfills.

12.2.3. Land Use

12.2.3.1. Renewable Energy Development

Abundant offshore wind resources have the potential to supply immense quantities of renewable energy to major U.S. coastal cities. While the U.S. currently does not have any operational projects yet, there are thousands of megawatts (MW) projects in the planning stages, mostly in the Northeast and Mid-Atlantic regions. Projects also are being considered along the Great Lakes, Pacific Coast, and Gulf of Mexico (USDOI, BOEM, 2015e).

In 2010, the USACE issued a Section 10 permit to Independent Natural Resources, Inc. to install a commercial wave-powered demonstration facility a mile off of Freeport, Texas. The offshore platform, dubbed the SEADOG, uses a buoy and piston mechanism combined with a water wheel to generate electricity and desalinate water (Patel, 2010). Other than this demonstration facility, there are no current wave energy projects in the Gulf of Mexico.

12.2.3.2. Ocean Dredged Material Disposal Sites

Most of the dredged material disposed in the ocean is disposed at ocean dredged material disposal sites (ODMDSs) specifically designated by the USEPA for dredged material disposal under Section 102 of the Marine Protection, Research, and Sanctuaries Act (MPRSA). The USACE is required to use such sites for ocean disposal to the extent feasible. The USEPA's ocean dumping regulations are found in 40 CFR part 228.

There are currently 9 ODMDSs off the coast of Louisiana and 17 sites off the coast of Texas (USEPA, 2014). These sites are listed here and their locations are identified in **Figure C-92**.

Louisiana

- Atchafalaya River and Bayous – Chene, Boeuf, and Black
- Atchafalaya River and Bayous – Chene, Boeuf, and Black (West)
- Barataria Bay Waterway
- Calcasieu Dredged Material Site 1
- Calcasieu Dredged Material Site 2
- Calcasieu Dredged Material Site 3
- Houma Navigation Canal
- Mississippi River Gulf Outlet
- Southwest Pass – Mississippi River

Texas

- Brazos Island Harbor
- Brazos Island Harbor (42-Foot Project)
- Corpus Christi Ship Channel
- Freeport Harbor – New Work (45-Foot Project)
- Freeport Harbor – Maintenance (45-Foot Project)
- Galveston Dredged Material Site
- Homeport Project – Port Aransas
- Matagorda Ship Channel
- Port Mansfield
- Sabine-Neches Dredged Material Site 1
- Sabine-Neches Dredged Material Site 2
- Sabine-Neches Dredged Material Site 3
- Sabine-Neches Dredged Material Site 4
- Sabine-Neches Dredged Material Site A
- Sabine-Neches Dredged Material Site B
- Sabine-Neches Dredged Material Site C
- Sabine-Neches Dredged Material Site D

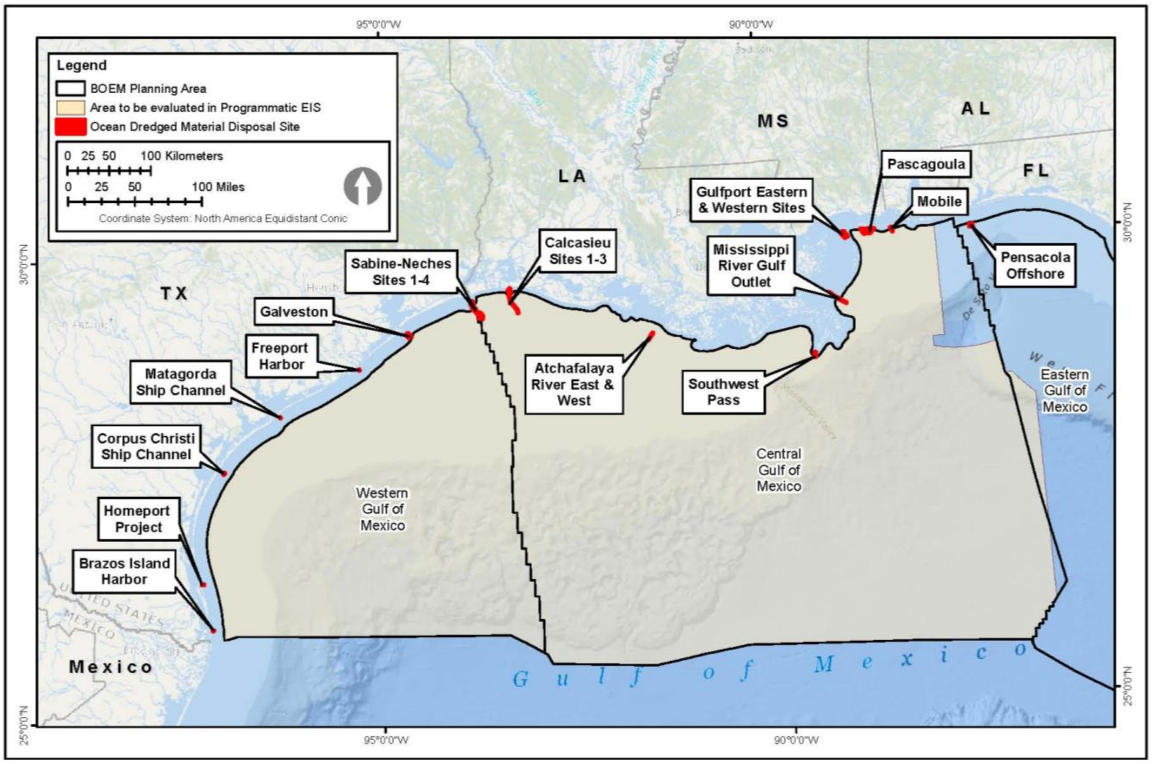


Figure C-92. Offshore Dredged Material Disposal Sites (ODMDSs) in the Gulf of Mexico.

12.2.3.3. Military Use Areas

The Gulf of Mexico region has a large USDOD presence with multiple Navy and Air Force facilities located along the coastal zone. The following is a list of USDOD facilities located by state in the Gulf of Mexico Program Area (**Figure C-93**).

Texas

- Naval Air Station Corpus Christi
- Naval Air Station Kingsville
- Naval Station Ingleside
- Ellington Air Force Base

Louisiana

- Naval Support Activity New Orleans
- Naval Air Station Joint Reserve Base New Orleans

Mississippi

- Naval Station Pascagoula
- Gulfport Battalion Center
- Keesler Air Force Base

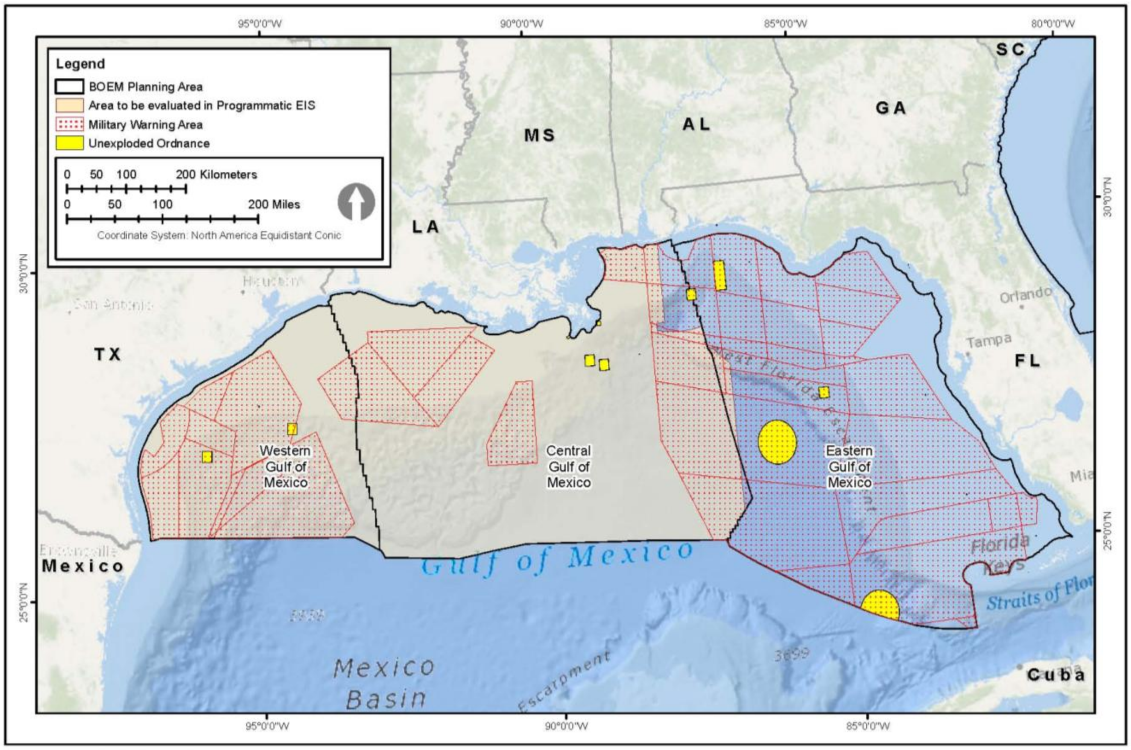


Figure C-93. Military Use Areas in the Gulf of Mexico.

Military use areas are established off all U.S. coastlines and are required by the U.S. Air Force, Navy, Marine Corps, and Special Operations Forces for conducting various testing and training missions. Military activities can be quite varied, but they normally consist of air-to-air, air-to-surface, and surface-to-surface naval fleet training, submarine and antisubmarine training, and Air Force exercises. **Figure C-93** shows the location of the military use areas in the Gulf of Mexico region. The region also has a number of military dumping areas (**Figure C-93**). These dumping areas are classified according to whether spoil, ordinance, chemical waste, or vessel waste is deposited in the area.

The U.S. Air Force has established multiple surface danger zones and restricted areas in the Gulf of Mexico region. The regulations pertaining to the identification and use of these areas are found in 33 CFR part 334 and are defined as follows:

- Danger Zone: A defined water area (or areas) used for target practice, bombing, rocket firing or other especially hazardous operations, normally for the armed forces. The danger zones may be closed to the public on a full-time or intermittent basis, as stated in the regulations.
- Restricted Area: A defined water area for the purpose of prohibiting or limiting public access to the area. Restricted areas generally provide security for Government property and/or protection to the public from the risks of property damage or injury arising from the Government's use of that area.

Units of the USDOD use surface danger zones and restricted areas in coastal and offshore waters for rocket launching, weapons testing, and conducting a variety of training and readiness operations. Most danger zones and restricted areas in the northern Gulf of Mexico are associated with Elgin Air Force Base (AFB) and Tyndall AFB, both of which are located in the Florida Panhandle (outside of the Gulf of Mexico Program Area). The danger zones extend from nearshore areas to hundreds of kilometers off the coast of Florida. There is also a danger zone associated with MacDill AFB in Tampa Bay.

The Gulf of Mexico Range Complex contains four separate operating areas (OPAREAs): Panama City, Pensacola, New Orleans, and Corpus Christi. The OPAREAs within the Gulf of Mexico Range Complex are not contiguous but are scattered throughout the Gulf of Mexico (**Figure C-93**). The Gulf of Mexico Range Complex includes special use airspace (SUAs) with associated warning areas, restricted airspace, and surface and subsurface sea space for the four OPAREAs (U.S. Fleet Forces Command, 2015). The offshore surface and subsurface area of the Gulf of Mexico Range Complex totals 59,817 km^2 (17,440 nmi^2) and includes 41,406 km^2 (12,072 nmi^2) of shallow ocean area <185 m (590 ft) deep (U.S. Fleet Forces Command, 2010). The Gulf of Mexico Range Complex is a key area where the U.S. Navy conducts surface and subsurface training and operations as well as shakedown cruises for newly built ships.

Aircraft operated by all USDOD units train within SUAs that overlie the OPAREAs, as designated by the Federal Aviation Administration (FAA) (U.S. Fleet Forces Command, 2010). SUAs with associated warning areas are the most relevant to the oil and gas leasing program because they are largely located offshore, extending from 3 nmi outward from the coast over international waters and in international airspace. These areas are designated as airspace for military activities, but because they occur over international waters, there are no restrictions on nonmilitary aircraft. The purpose of designating such areas is to warn nonparticipating pilots of potential danger. When they are being used for military exercises, the controlling agency notifies civil, general, and other military aviation organizations of the current and scheduled status of the area (U.S. Department of the Navy, 2004). Aircraft operations conducted in warning areas primarily involve air-to-air combat training maneuvers and air intercepts, which are rarely conducted at altitudes below 1,524 m (5,000 ft) (U.S. Department of the Navy, 2002).

Security group training areas are also located in marine waters of the Gulf of Mexico Range Complex. There are two group training areas: one is located 13 km (8 mi) off the coast of Panama City, Florida; the other is 13 km (8 mi) off the coast of Corpus Christi, Texas. These areas are used for machine gun and explosives training (U.S. Fleet Forces Command, 2010).

In a 2010 report on the compatibility of USDOD activities with oil and gas resource development on the OCS, the USDOD Office of the Director of Operational Testing and Evaluations determined that both the Key West and Panama City OPAREAs were not compatible with oil or gas activity (USDOD, 2010). The justifications for the Key West OPAREA included live fire air-to-air and air-to-ground missile exercises. For the Panama City OPAREA the justifications included mine warfare and testing, helicopter transit, towed underwater sensors, and airborne laser mine detection systems.

12.3. ATLANTIC PROGRAM AREA

The coastline within the Atlantic Program Area is approximately 1,127 km (700 mi) long. Land use is a heterogeneous mix of urban areas; manufacturing, marine, shipping, and agricultural areas; recreational areas; and tourist attractions. There are numerous urban areas in the region, and a complexity of land uses associated with urbanization can be found there. Military facilities and training areas are discussed below. The coastal region adjacent to the Atlantic Program Area contains 2 of the 20 most populous U.S. cities (Baltimore, Maryland and Charlotte, North Carolina), approximately 8 percent of the nation's coastal population (Wilson and Fischetti, 2010), and 4 of the nation's 20 largest ports, 2 of which (Norfolk, Virginia and Savannah, Georgia) are close to the Atlantic Program Area (USACE, 2012).

The coastal region adjacent to the Atlantic Program Area contains a mix of bays, estuaries, wetlands, barrier islands, and beaches of great environmental and economic value. Some of these areas support fishing (adding >$1.5 billion in total value to the Mid-Atlantic region alone), shrimping, and related economic activities, and although accessibility is sometimes limited, many of these areas are very popular for recreation and tourism. There are numerous state parks and beaches as well as national parks, National Seashores, and NWRs. For a discussion of many of these areas as well as marine sanctuaries and MPAs, see **Section 9.3 – Areas of Special Concern**.

All of the states in the Atlantic region participate in the national CZM Program and have taken various approaches to managing their coastal lands. All of the states in the Atlantic Program Area, except

Florida, have authority over submerged lands to approximately 3 nmi (5.6 km) from the coast. Florida has jurisdiction to approximately 9 mi (16.7 km).

12.3.1. Listed Infrastructure

Potential OCS-related infrastructure in the Atlantic Program Area includes the following:

- **Port Facilities**. Major maritime staging areas for movement between onshore industries and infrastructure and offshore leases.
- **Platform Fabrication Yards**. Facilities in which platforms are constructed and assembled for transportation to offshore areas. Facilities can also be used for maintenance and storage.
- **Shipyards and Shipbuilding Yards**. Facilities in which ships, drilling platforms, and crew boats are constructed and maintained.
- **Support and Transport Facilities**. Facilities and services that support offshore activities. This includes repair and maintenance yards, supply bases, crew services, and heliports.
- **Pipelines**. Infrastructure that is used to transport oil and gas from offshore facilities to onshore processing sites and ultimately to end-users.
- **Pipe Coating Yards**. Sites that condition and coat pipelines used to transport oil and gas from offshore production locations.
- **Natural Gas Processing Facilities and Storage Facilities**. Sites that process natural gas and separate its component parts for the market, or that store processed natural gas for use during peak periods.
- **Refineries**. Industrial facilities that process crude oil into numerous end-use and intermediate-use products.
- **Petrochemical Plants**. Industrial facilities that intensively use oil and natural gas and their associated byproducts for fuel and feedstock purposes.
- **Waste Management Facilities**. Sites that process drilling and production wastes associated with offshore oil and gas activities.
- **Aviation Infrastructure**. Aviation industry locations that could support the oil and gas industry.
- **Renewable Energy Development**. Potential wind energy areas (WEAs) whose activities may impact or be impacted by oil and gas activities.
- **Ocean Dredged Material Disposal Sites**. Sites used for the disposal of dredged material from the maintenance dredging of commercial and military ports.
- **Military Use**. Military sites within the planning area that are situated on the shore and whose activities may impact, or be impacted by, offshore oil and gas activities within the Atlantic Program Area.
- **NASA Use**. NASA sites on shore whose activities may impact, or be impacted by oil and gas activities within the program area.

12.3.1.1. Port Facilities

Ports adjacent to the Mid-Atlantic Planning Area handle approximately 5 percent of total U.S. waterborne traffic, and Norfolk Harbor is the 15th largest U.S. port. While the South Atlantic Planning Area does not have as many adjacent ports, 3 are in the top 40 most trafficked U.S. ports (USACE, 2012): Savannah, GA (20th), Charleston, SC (33rd), and Jacksonville, FL (39th).

The six commercial deepwater ports adjacent to the Mid-Atlantic and South Atlantic Planning Areas are listed here (**Figures C-94a** and **C-94b**). Although it is included in the list, Jacksonville, Florida does not adjoin the Mid-Atlantic or South Planning Areas.

- Norfolk, Virginia (Port of Virginia);
- Wilmington, North Carolina (64th);
- Charleston, South Carolina;
- Savannah, Georgia;
- Brunswick, Georgia (93rd); and
- Jacksonville, Florida.

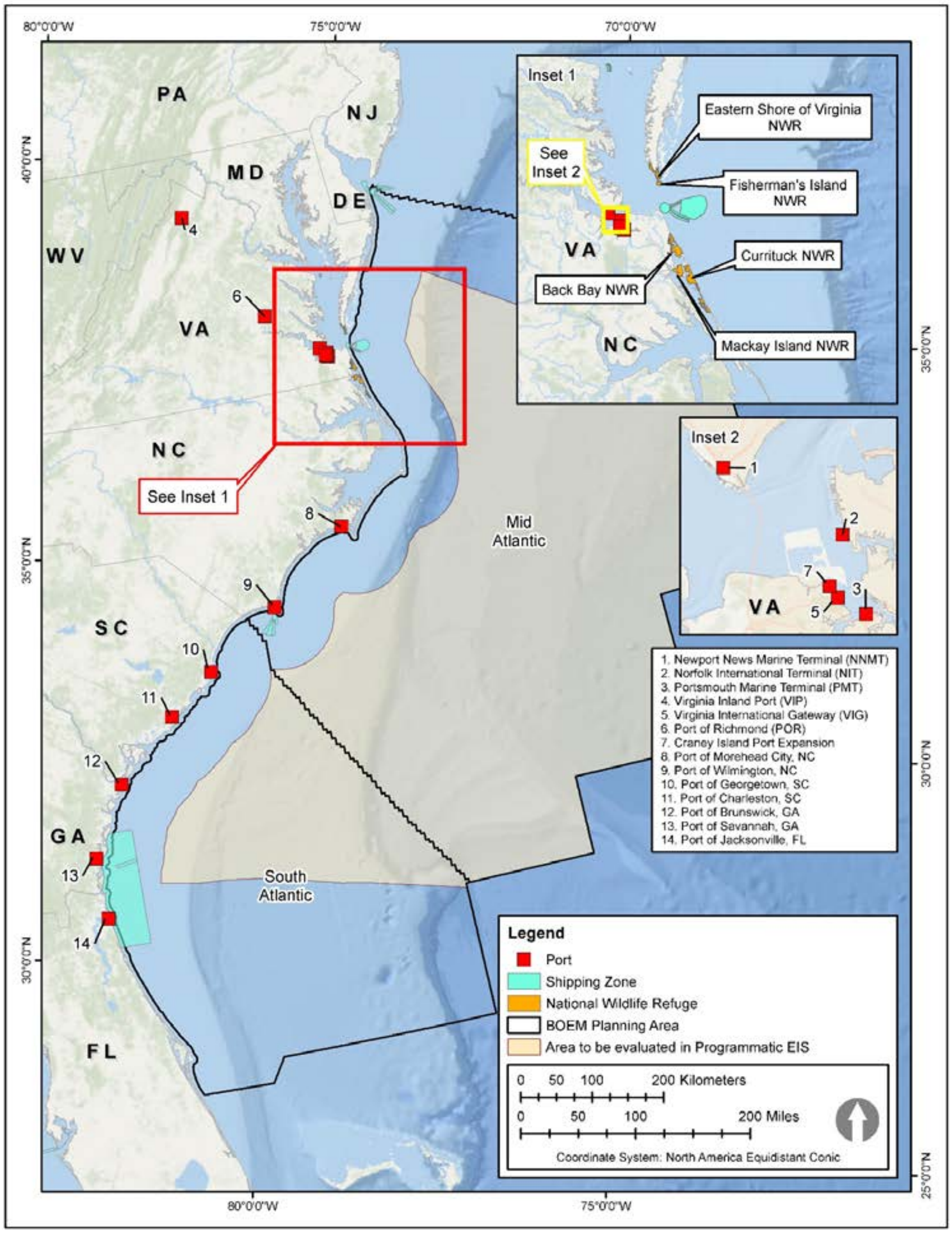


Figure C-94a. Commercial Deepwater Ports and Shipping Zones Within the Mid-Atlantic and South Atlantic Planning Areas.

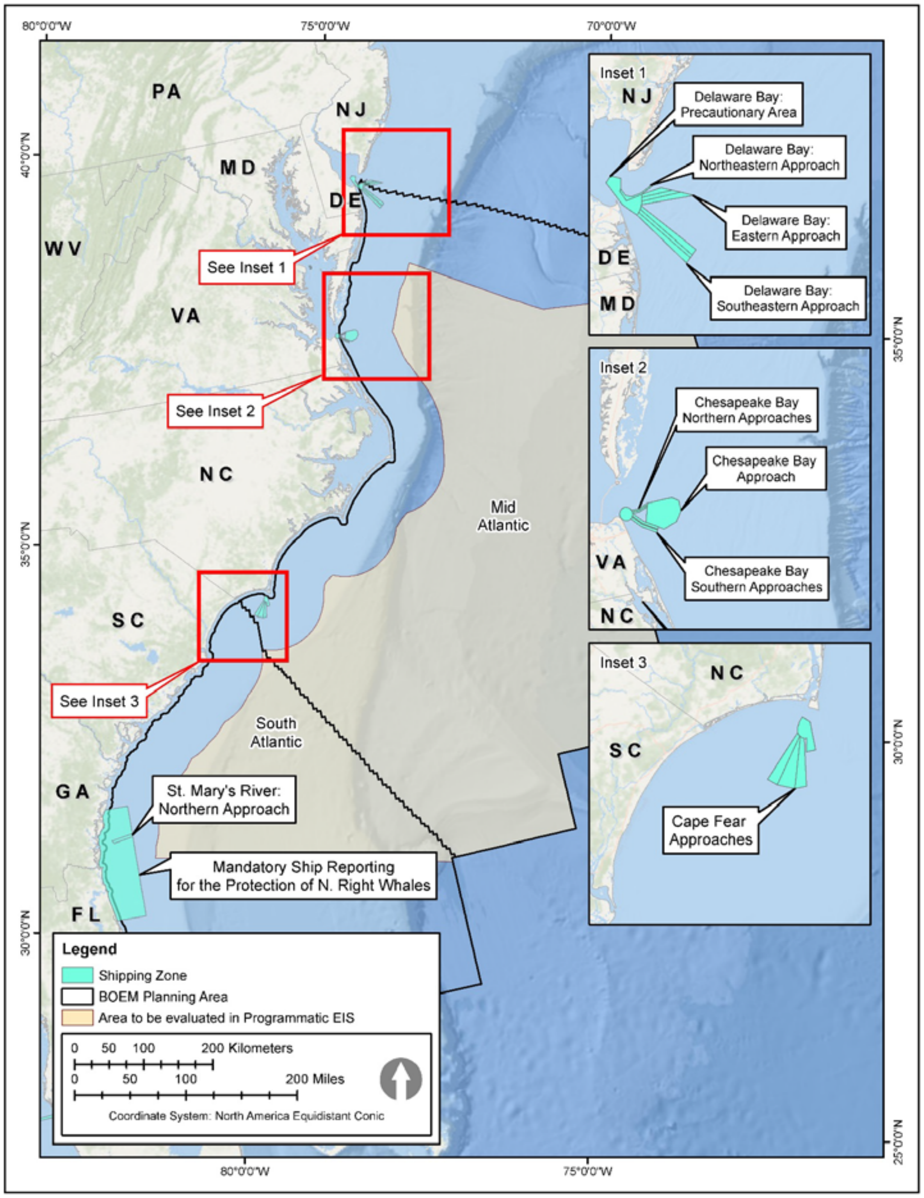


Figure C-94b. Commercial Deepwater Ports Adjacent to the Mid-Atlantic and South Atlantic Planning Areas.

Information about the five ports within the Program Area is provided in the following subsections. In addition, in the Mid-Atlantic planning area, Delaware Bay provides access to Delaware River ports and terminals in the Wilmington, DE (72nd) and Philadelphia, PA (25th) area. Access to the Port of Baltimore (16th) is provided through Delaware Bay via the Chesapeake and Delaware Canal, or through the Chesapeake Bay. Due to the proximity of the Atlantic Program Area, the port of Jacksonville and its three cargo terminals and one passenger terminal could provide support for a large event within the Atlantic Program Area. There are numerous smaller ports in Maryland and Virginia that can be accessed through the Chesapeake Bay. Smaller coastal ports also are located in North Carolina (Morehead City – 86th) and in South Carolina (Georgetown).

Shipping and maritime vessel activity in the six major coastal commercial ports and the three ports associated with the Chesapeake Bay and the Delaware Bay are substantial. In 2012, a combined total of more than 15,000 vessel arrivals occurred in these major ports (U.S. Maritime Administration, 2012).

Actual vessel movements consider both vessel approach/arrival and departure from a port facility, indicating that vessel transits levels through the region are approximately twice the vessel arrival levels. Based on 2004 USCG data, >54,000 vessel transits (involving commercial vessels of at least 150 gross register tonnage (GRT) occurred at U.S. ports on the Atlantic coast per year. A significant proportion of these transits either use ports in or may traverse waters of the planning area during inbound or outbound transit (USDOI, BOEM, 2014). The following information is provided for the ports adjacent to the Atlantic Program Area.

12.3.1.1.1. Port of Virginia (Norfolk, Portsmouth, and Newport News, Virginia)

The Port of Virginia has its largest terminal in Norfolk, with additional terminals in Portsmouth, Newport News, Richmond, and the Virginia International Gateway in Portsmouth. In addition, there is an inland terminal in Front Royal, Virginia (Warren County). The Virginia Inland Port is an intermodal container transfer facility owned by the Virginia Port Authority. It provides service to inland markets and enhances service to the Washington D.C.-Baltimore Metro Region by providing rail service to the terminals in Hampton Roads. Virginia Inland Port also consolidates and containerizes local cargo for export. Containerized rail service is provided five days a week to Virginia Inland Port from both Norfolk International Terminals and the Virginia International Gateway in Portsmouth.

With the exception of Richmond, all terminals are located at the mouth of the Hampton Roads natural harbor that opens to the mouth of the Chesapeake Bay. These terminals are located in an urban area with a mix of industrial, commercial, and residential uses. This is a relatively large area including communities on both sides of the Hampton Roads Harbor, seven counties, and nine cities, including the cities of Norfolk, Virginia Beach, Portsmouth, Newport News, and Hampton. There are also several small parks in the area. The mouth of the Chesapeake Bay, connecting the port terminals to the sea, is bordered to the south by urban beaches of the cities of Norfolk and Virginia Beach. To the north and south there are several NWRs, including the Eastern Shore of Virginia NWR, Fisherman Island NWR, Back Bay NWR, Mackay Island NWR, and Currituck NWR. The mouth of the harbor is more than 3.2 km (2 mi) wide and borders urban residential areas in the cities of Hampton (to the north) and Norfolk (to the south) (USDOI, BOEM, 2014).

From 2009 to 2013, the Port of Virginia saw a 26.2 percent increase in tonnage throughput to almost 19 million shorts tons (Virginia Port Authority, 2014). In addition, the previously closed cruise ship terminal is back in operation, with 12 visit trips and six round trips scheduled for 2015.

The Virginia Port Authority is developing a new marine terminal on Craney Island, in Portsmouth. The first phase is scheduled for completion in 2028, with the entire facility to be completed in 2039. This project is estimated to more than double the current containerized capacity at the existing Virginia Port Authority properties (Greer et al., 2013).

12.3.1.1.2. Ports of North Carolina

The North Carolina Port Authority operates marine ports in Wilmington and Morehead City, plus inland terminals in Charlotte and the Piedmont Triad in Greensboro. These inland ports link the state's consumers, businesses and industry to world markets. Both coastal terminals have rail access.

The Port of Wilmington is located in New Hanover County, North Carolina, on the eastern banks of the Cape Fear River. It is surrounded by industrial and residential areas of the City of Wilmington to the east, and the Cape Fear River to the west. Eagle Island, containing a dredged material disposal facility managed by the USACE, is located across the river from the port. The port is connected to the sea by an approximately 42-km (26-mi) long channel along the Cape Fear River. The lands to the west of the navigation channel are part of Brunswick County and for the most part are undeveloped. They include the Brunswick Town State Historic Site, the Sunny Point Military Ocean Terminal (the largest military terminal in the U.S) and, close to the mouth of the river, the city of Southport. The lands to the east of the navigation channel are part of New Hanover County and for the most part are undeveloped, with some intermixed residential areas, Carolina Beach State Park, and Fort Fischer State Recreation Area. At the mouth of the river is the small village of Bald Head Island (USDOI, BOEM, 2014). The 10-year tonnage trend for this port shows a general increase in tonnage from 3 million to 4.6 million tons. Additionally, recently, a cruise ship called on the Port of Wilmington. This port call represents a new trend in cruising – domestic cruises with short port calls along the U.S. coast.

One of the deepest ports on the Atlantic Coast, the Port of Morehead City is located just 6.4 km (4 mi) from the Atlantic Ocean. The port handles both breakbulk and bulk cargo and is the second largest importer in the country for natural rubber. It is also one of the leading exporters of phosphate.

The Port of Wilmington currently is conducting a feasibility study weighing options for upgrading the port, making it more accessible to increased traffic and larger vessels (USDOI, BOEM, 2014).

12.3.1.1.3. Ports of South Carolina

The Port of Charleston consists of five terminals, four of them located on the western bank of the Cooper River and one on the eastern bank of the Wando River, all in Charleston County, South Carolina. Additionally, an inland port located in Greer, South Carolina was opened in November 2013, with the expectation of transporting up to 40,000 containers per year between Greer and the port of Charleston. Land use around the port is a mix of industrial, commercial, and residential areas, with some undeveloped land along the banks of the Cooper and Wando Rivers. The port terminals are located 8 to 16 km (5 to 10 mi) from the sea in a natural harbor along which there are several residential areas as well as the USS Yorktown State Park. The harbor leading to the sea is between 1.6 and 4.8 km (1 and 3 mi) wide, with residential piers, particularly on the north side. Most of the terminals face small, undeveloped areas across the river (South Carolina Port Guide, 2014; USDOI, BOEM, 2014).

Charleston participation in the cruise industry also is growing. There is the potential for up to 100 visits by cruise lines in 2015, given improvements implemented in 2013, and others are planned for the future (South Carolina Port Guide, 2014).

A new container terminal is currently under construction at the Port of Charleston. The anticipated opening date of the terminal’s 69-ha (171-ac) first phase is planned for fiscal year 2019 or as market demand requires.

The port of Georgetown is South Carolina’s dedicated breakbulk and bulk cargo port. Top commodities for the Port of Georgetown are steel, cement, aggregates, and forest products. The terminal is located approximately 23 km (14.3 mi) from the Atlantic Ocean.

12.3.1.1.4. Port of Savannah, Georgia

The Port of Savannah is located in Chatham County, Georgia, on the border with South Carolina. Home to the largest single-terminal container facility of its kind in North America, it is composed of two modern deepwater terminals: Garden City Terminal and Ocean Terminal. The Garden City Terminal is the fourth busiest U.S. container handling facility, encompassing >486 ha (1,200 ac) and moving millions of tons of containerized cargo annually. Ocean Terminal, Savannah’s dedicated breakbulk and roll-on/roll-off facility, covers more than 81 ha (200 ac). Both terminals are on the west bank of the Savannah River, within the Savannah urban area. Land use to the west of the port’s terminals is a mix of industrial and residential uses. To the east, the Savannah River waters are often no more than 275 m (900-ft) wide, with relatively undeveloped portions of Hutchinson Island and Kings Island on the opposite side. Part of the northern terminal faces the Savannah NWR. The Garden City Terminal is located approximately 32 km (20 mi) upstream from the Atlantic Ocean. The Ocean Terminal is located approximately 26 km (16 mi) from the ocean. The banks along the river channel leading to the sea are mostly undeveloped and include recreational areas such as the McQueen’s Island Historic Trail, the Fort Pulaski National Monument, and the Tybee Island beaches at the mouth of the river. The Tybee NWR lies to the north of the river, in South Carolina. The Savannah historic district with its colonial buildings lies along the river banks to the south of the port (USDOI, BOEM, 2014).

Georgia inland terminal operations, Port Bainbridge and Port Columbus, provide a strategic advantage for bulk commodities moving to and from the southeastern U.S.

Several expansion projects are currently underway at the Port of Savannah. These infrastructure improvements, which include additional cranes, operational improvements and container storage consolidation, will increase annual throughput capacity from 4.5 million to 6.5 million twenty-foot equivalent unit (TEUs).

12.3.1.1.5. Port of Brunswick, Georgia

The Port of Brunswick comprises three deepwater terminals owned by the Georgia Port Authority, two of which are directly operated by the Georgia Port Authority. All terminals have rail access. The port's main commodity involves transshipment of auto and heavy machinery. The Colonel's Island Terminal conducts bulk export/import operations, ensuring that imports and exports, including agricultural products from Georgia and the U.S. grain belt, flow smoothly across the Colonel's Island docks. This 688-ha (1,700-ac) site is approximately 15 km (9 mi) from the Atlantic Ocean. Brunswick's Mayor's Point Terminal exports forest products from a 9-ha (22-ac) site. It is located approximately 14.5 km (9 mi) from the ocean. The Marine Port Terminals, a 59-ha (145-ac) facility operated by a private company, specializes in handling breakbulk and bulk commodities. This terminal is approximately 13 km (9 mi) from the ocean.

12.3.1.1.6. U.S. Navy Ports

There are five U.S. Navy ports and naval shipyards adjacent to the Atlantic Program Area from which Navy surface and submarine ships operate and perform maintenance and testing (**Figure C-95**). Only Naval Station Mayport is not located within the Atlantic Program Area. It is identified only due to its close proximity to the southern boundary of the Atlantic Program Area. These facilities are described in further detail in **Section 12.3.1.1**:

- Naval Station Norfolk, Norfolk, Virginia
- Joint Expeditionary Base Little Creek – Fort Story, Virginia Beach, Virginia
- Norfolk Naval Shipyard, Portsmouth, Virginia
- Naval Submarine Base Kings Bay, Kings Bay, Georgia
- Naval Station Mayport, Jacksonville, Florida

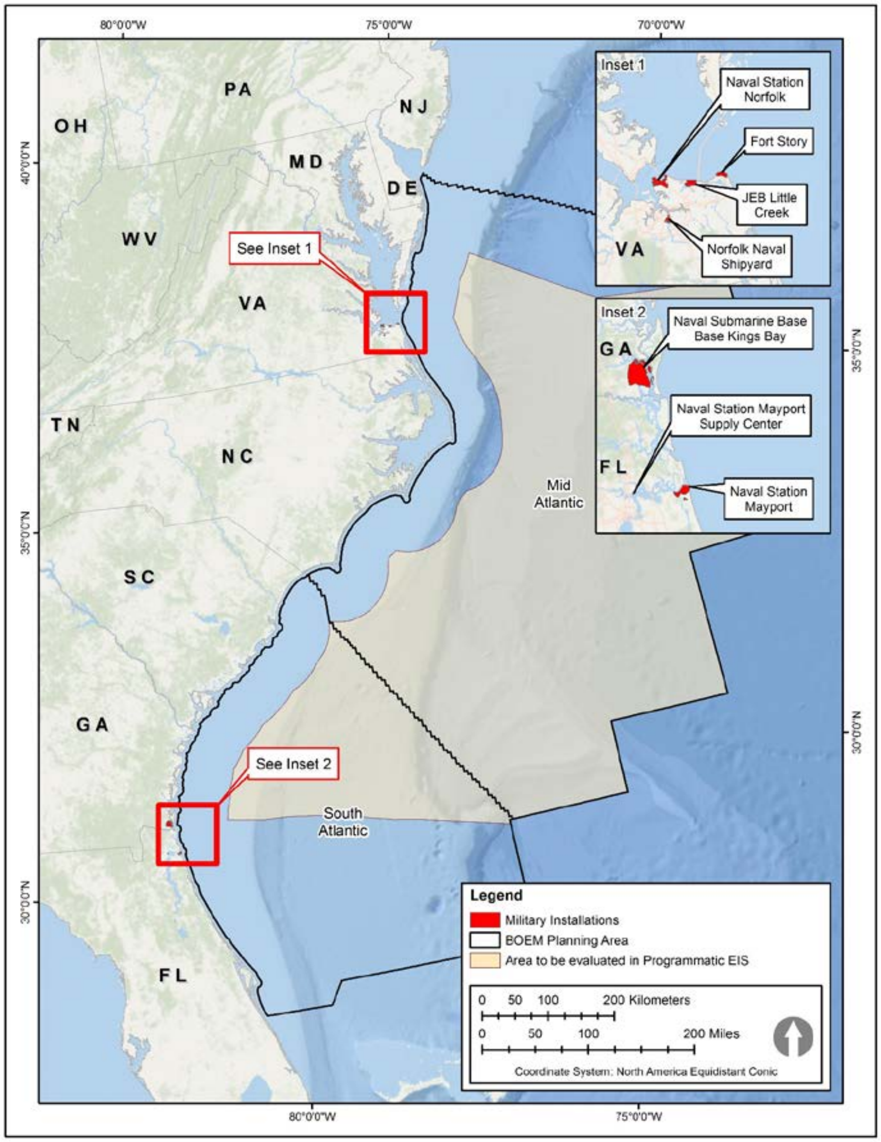


Figure C-95. Ports and Naval Shipyards Adjacent to the Atlantic Program Area.

12.3.1.2. Platform Fabrication Yards

Offshore drilling and production platforms are fabricated onshore at platform-fabrication yards and then towed to an offshore location for installation. Production operations at fabrication yards include cutting and welding of steel components, construction of living quarters and other structures, and assembly of platform components. Platform fabrication yards must be located on navigable channels large enough to allow towing bulky and long structures such as offshore drilling and production platforms. Most fabrication yards are located within easy access to the ocean. Typical fabrication yards typically occupy large areas, ranging from just a few to several hundred acres. Equipment at these facilities includes lifts and cranes, various types of welding equipment, rolling mills, and sandblasting machinery. Besides large open spaces required for jacket assembly, fabrication yards also have covered warehouses and shops. Fabrication yards typically specialize in the production of one type of platform or one type of platform component. Few facilities have complete capabilities for all facets of offshore projects, and yards may cooperate in the development of platforms.

There are no platform fabrication yards within the Atlantic Program Area (Dismukes, 2014).

12.3.1.3. Shipyards

A 2014 survey from Marine Log identified coastal shipyards and repair yards within the Mid-Atlantic and South Atlantic Planning Areas (**Table C-74**).

Table C-74. Coastal Shipyards and Repair Yards in the Mid-Atlantic and South Atlantic Planning Areas.

State	Ship Builders				Ship Repairers			
	Large	Medium	Small	Yacht	Large	Small	Topside	Yacht
Mid-Atlantic and South Atlantic Planning Areas								
Georgia	0	0	0	0	0	1	0	0
Maryland	0	0	1	0	0	2	0	0
North Carolina	0	0	1	1	0	0	0	0
South Carolina	0	0	1[a]	0	1	2[a]	0	0
Virginia	1[a]	0	0	0	3[a]	4	2	0
Total	**1**	**0**	**3**	**1**	**4**	**9**	**2**	**0**
Additional Shipyards Located in the Mid-Atlantic and South Atlantic Planning Areas								
Pennsylvania	0	1	0	0	1	1	0	0
Delaware	0	0	0	0	0	0	0	0
Florida	0	1[a]	1	2[a]	0	3[a]	0	1[a]
Additional Totals	**0**	**2**	**1**	**2**	**1**	**4**	**0**	**1**
Total	**1**	**2**	**4**	**3**	**5**	**13**	**2**	**1**

[a] These facilities are identified as having both build and repair capabilities.

A "large" builder is capable of manufacturing large ocean-going naval and/or commercial ships and has a very large, fully facilitated shipyard, with extensive in-house design capabilities. A "medium" builder is capable of manufacturing mid-sized ocean-going ships and barges, and has a mid-sized, fully facilitated shipyard, with in-house design capabilities. A "small" builder is capable of manufacturing small ships, boats, and barges, which are designed for coastal or inland service. Its shipyard has limited facilities and capabilities. A "yacht" builder manufactures custom-designed and custom-built yachts that are generally at least 75 ft in length.

A large ship repair facility is capable of dry-docking an ocean-going vessel of at least Panamax beam (106 ft). A small repair facility is capable of dry-docking small boats and barges. A "topside" repairer only has topside capability (i.e., no dry-docking capability). **Table C-74** does not include the following:

- Shipyards that only build or repair small pleasure craft and/or non-commercial fishing vessels;
- Shipyards that are essentially manufacturers or machine shops, with no waterfront operations; and
- Shipyards that are essentially maintenance departments for their parent companies.

The number was determined by hand counting the individual addresses listed for each of the facilities (Marine Log, 2014).

12.3.1.4. Support and Transport Facilities

Support and transport facilities for offshore activities do not exist in the Atlantic Program Area at this time. The first step in providing these resources depends on port development to support the offshore industry (Dismukes, 2014). The development of these support and transport facilities would track with improvements to the applicable port facilities.

12.3.1.5. Pipelines

There are no pipeline landfalls in the Mid-Atlantic and South Atlantic Planning Areas, as there currently are no oil platforms there (Dismukes, 2014). **Figure C-96** shows the pipeline network for the Mid-Atlantic and South Atlantic Planning Areas (USEIA, 2014).

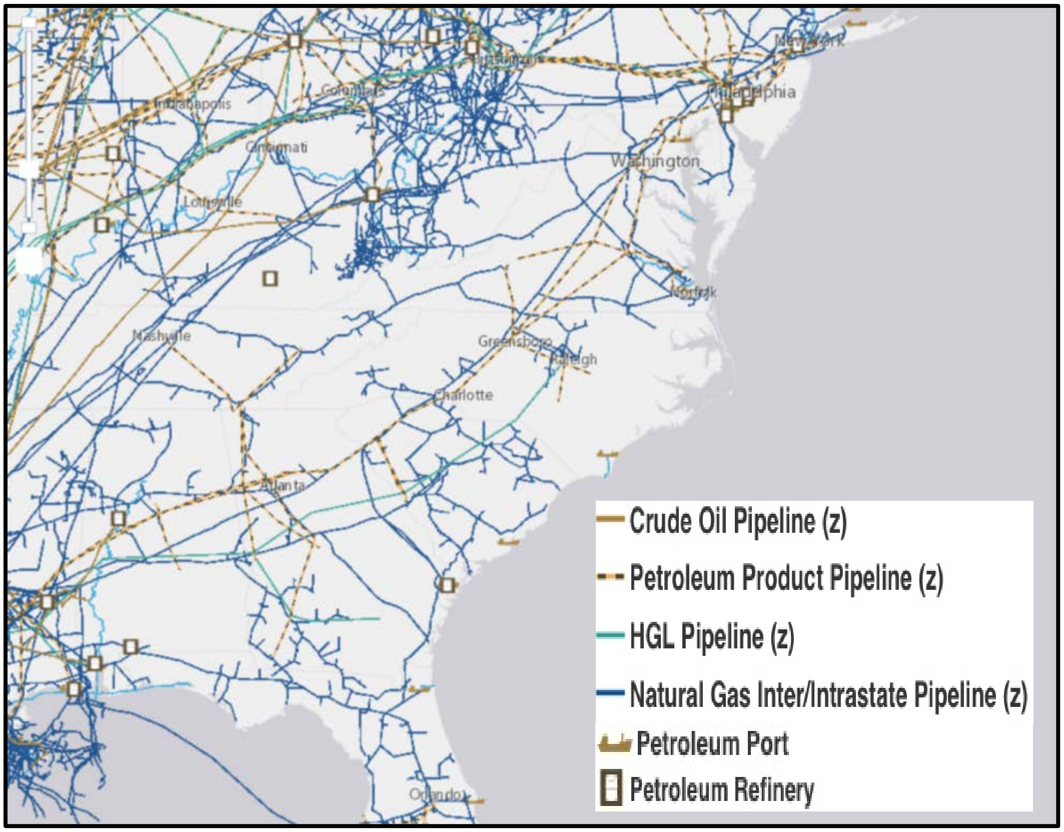


Figure C-96. Atlantic coast Petroleum Pipelines, Refineries, and Ports.

12.3.1.6. Pipecoating Plants and Yards

Pipecoating plants in the Mid-Atlantic and South Atlantic Planning Areas are located primarily in Pennsylvania, with a small number of plants distributed among other states (**Table C-75**) (Thomasnet.com).

Table C-75. Pipecoating Plants in the Atlantic Program Area.

State	Number of Pipecoating Plants
Pennsylvania	20
Delaware	2
Maryland	1
Virginia	2
North Carolina	3
South Carolina	3
Georgia	2
Florida	5

12.3.1.7. Natural Gas Processing Plant and Storage Facilities

As of 2014, there are no gas-processing plants in the Atlantic Program Area. However, there are several processing and storage locations in the Appalachian Mountains. There are two storage facilities located in the far western portion of southern Virginia, approximately 547 km (340 mi) due west of the port of Norfolk, Virginia (USEIA, 2012).

12.3.1.8. Refineries

The entire Mid-Atlantic and South Atlantic Planning Area contains two refineries. The only refinery adjacent to the Atlantic Program Area is one inactive refinery in Georgia. The second refinery is in Delaware on the Delaware Bay. For informational purposes, four other refineries are located on the Delaware River, within easy reach of the Atlantic Program Area. While these refineries are located outside of the Mid-Atlantic Program, they still may be utilized rather than building new structures. All four are located on the Delaware River, with two in Pennsylvania and two in New Jersey. There are no refineries in North Carolina, South Carolina, Maryland, Virginia, or Florida (USEIA, 2014).

Atlantic Coast refineries received more than half of their crude oil feedstocks by rail (USEIA, 2014). Although early 2015 capacity utilization within the area was below normal, 52 percent of the plants' total monthly rail receipts marked the first time in the USEIA's dataset that crude-by-rail deliveries accounted for such a high percentage of Atlantic Coast refinery supplies. Rail shipments of crude to Atlantic Coast refineries within Petroleum Administration for Defense District 1 have displaced waterborne imports from countries other than Canada, such as Nigeria. Growth of inland U.S. and Canadian production of light, sweet crude since 2010 created opportunities for both nations' railroads to move crude to refineries on the Atlantic Coast, Gulf of Mexico coast, and West Coast as well as to plants in Canada (USEIA, 2014).

Savannah, Georgia

The Axeon Specialty Products Savannah Refinery has a throughput capacity of 32,000 barrels per day of asphalt. However this refinery is currently inactive.

Delaware City, Delaware

The Delaware City Refinery has a throughput capacity of 190,000 bpd and a Nelson complexity rating of 11.3. As a result of its configuration and petroleum refinery processing units, Delaware City has the capability to process a diverse heavy slate of crudes with a high concentration of high sulfur crudes, making it one of the largest and most complex refineries on the Atlantic coast.

The Delaware City Refinery is located on a 2,023 ha (5,000-ac) site on the Delaware River, with the ability to accept crude by rail or via waterborne cargoes. Delaware City possesses an extensive distribution network of pipelines, barges and tankers, trucks and rail for the distribution of its refined products.

Paulsboro, New Jersey

The Axeon Specialty Products Paulsboro Refinery has a throughput capacity of 180,000 bpd and a Nelson complexity rating of 13.2. The Paulsboro refinery is located on approximately 385 ha (950 ac) on the Delaware River in Paulsboro, New Jersey, just south of Philadelphia and approximately 48 km (30 mi) north of the Delaware City refinery. The Paulsboro and Delaware City refineries are the only two operating petroleum refineries on the Atlantic coast with coking capacity.

The Paulsboro refinery processes a variety of medium to heavy sour crude oils and predominantly produces gasoline, heating oil and aviation jet fuel. The refinery also manufactures Group I lubricant base oils. In addition to its finished clean products slate, Paulsboro produces petroleum coke and has a throughput of 75,000 bpd of asphalt.

Philadelphia, Pennsylvania

Philadelphia Energy Solutions now runs the 355,000 bpd Philadelphia Refining Complex, which includes the Point Breeze and Girard Point refineries.

Trainer, Pennsylvania

Monroe Energy LLC, a subsidiary of Delta Airlines, operates the Trainer, Pennsylvania refinery that has a throughput of 190,000 bpd. Delta Airlines purchased the refinery in June 2012 to recalibrate the plant to produce more jet fuel. Trainer also supplies refined products to Phillips 66 and BP.

Marcus Hook, Pennsylvania

The 175,000 bpd Marcus Hook refinery was idled at the end of 2011 and now serves as a Sunoco Logistics tank farm, storing gasoline and middle distillates.

12.3.1.9. Petrochemical Plants

A review of the American Fuel and Petrochemical Manufacturers (AFPM) website identified 13 companies that provide petrochemical services/products within the Atlantic Program Area. There are approximately 10 plants in Virginia, 9 in North Carolina, 8 in South Carolina, and 10 in Georgia.

12.3.1.10. Waste Management Facilities

Waste management facilities adjacent to the Atlantic Program Area region that handle OCS oil and gas activity-related waste could include transfer facilities and landfills (USDOI, BOEM, 2012). There are a small number of oil field waste disposal facilities located in the mid-Atlantic states; most have been developed to support Appalachian drilling activities (Dismukes, 2014).

There are many permitted Hazardous Waste – Treatment, Storage, and Disposal facilities that exist adjacent to the Atlantic Program Area. There are three sites within Virginia, eight sites within Georgia, eleven sites within North Carolina, and two sites within South Carolina that are permitted to handle hazardous wastes (USEPA, 2015).

12.3.1.11. Aviation Infrastructure

Offshore helicopter support is most often used for personnel transfer, medical evacuation and delivery of small parts and supplies. Helicopters used in this service generally have a range of 300 to 500 mi depending on their size and configuration. Due to the high hourly cost of helicopter operations, offshore service companies locate their heliports as close to the center of drilling and production as is practical.

Very few commercial airports are located along the Gulf of Mexico's U.S. coast. Therefore, offshore service companies have constructed private heliports to serve the offshore drilling and production platforms. However, in the Mid-Atlantic Region, there are at least nine small to mid-sized public airports with sufficient infrastructure to support a helicopter operation on or near the coast. The coastal airports identified in the Mid-Atlantic and South Atlantic Planning Areas include the following:

- Chorman Airport – Farmington, Delaware
- Laurel Airport – Laurel, Delaware
- Sussex County Airport – Georgetown, Delaware
- Ocean City Municipal Airport – Ocean City, Maryland
- Salisbury Wicomico Regional Airport – Salisbury, Maryland
- Accomack County Airport – Melfa, Virginia
- Patrick Henry International Airport – Newport News, Virginia
- Norfolk International Airport – Norfolk, Virginia

- Chesapeake Regional Airport – Chesapeake, Virginia
- Hampton Road Executive Airport – Chesapeake, Virginia
- Elizabeth City Regional Airport – Elizabeth City, North Carolina
- Dare County Regional Airport – Manteo, North Carolina
- Coastal Carolina Regional Airport – New Bern, North Carolina
- Michael J. Smith Field Airport – Beaufort, North Carolina
- Wilmington International Airport – Wilmington, North Carolina
- Grand Strand Airport – North Myrtle Beach, South Carolina
- Myrtle Beach International Airport – Myrtle Beach, South Carolina
- Georgetown County Airport – Georgetown, South Carolina
- Charleston International Airport – Charleston, South Carolina
- Charleston Executive Airport – Charleston, South Carolina
- Beaufort MCAS/Merritt Field Airport – Beaufort, South Carolina
- Hilton Head Airport – Hilton Head, Georgia
- Savannah/Hilton Head International Airport – Savannah, Georgia
- Brunswick Golden Isle Airport – Brunswick, Georgia
- Malcolm McKinnon Airport – Brunswick, Georgia
- St. Marys Airport – St. Marys, Georgia
- Jacksonville International Airport – Jacksonville, Florida
- Craig Municipal Airport – Jacksonville, Florida
- Flagler County Airport – Palm Coast, Florida
- Daytona Beach International Airport – Daytona Beach, Florida
- New Smyrna Beach Municipal Airport – New Smyrna Beach, Florida
- Melbourne International Airport – Melbourne, Florida

Together, these airports cover the entire Mid-Atlantic and South Atlantic Planning Areas (Fugro Consultants, Inc., 2015; city-data.com)

12.3.2. Land Use

12.3.2.1. Renewable Energy Development

The USDOI has identified three WEAs offshore the mid-Atlantic coast, one offshore each of Delaware, Maryland, and Virginia (**Figure C-97**). Only the Virginia WEA is within the Atlantic Program Area. In January 2012, BOEM issued a Final Environmental Assessment (EA) for these areas that included changes to the extent of the Maryland and Virginia WEAs.

Renewable energy leases have been executed along the Atlantic Coast, with site assessment and construction activities potentially occurring in the 2017 to 2022 timeframe. BOEM is considering offering additional areas for lease and is processing unsolicited requests for research and limited leases and right-of-way grants.

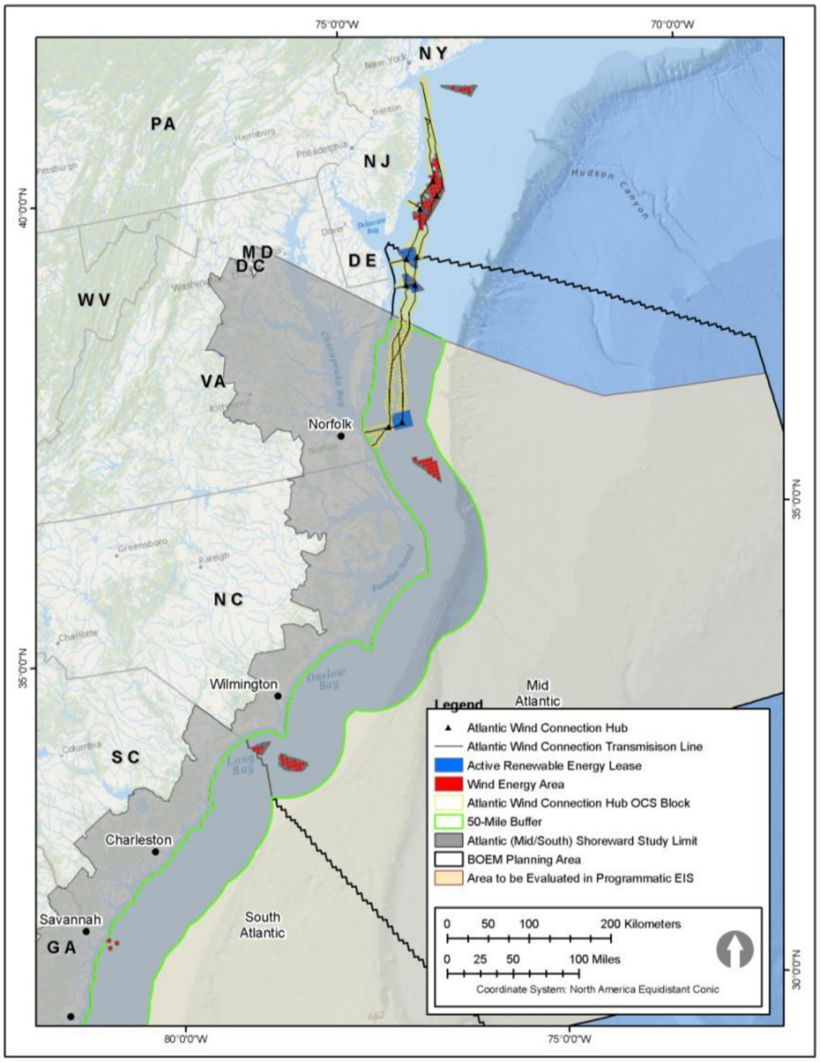


Figure C-97. Identified Offshore WEAs and Active Renewable Energy Lease Areas Along the Atlantic (From: MarineCadastre.gov).

12.3.2.1.1. Mid-Atlantic Planning Area

On May 1, 2013, Atlantic Grid Holdings LLC submitted a supplement to its application for the Atlantic Wind Connection. The supplement updates the project application, in which the company proposes to build an offshore high voltage direct current transmission system offshore New York, New Jersey, Maryland, Delaware, and Virginia that would interconnect offshore wind generation to the onshore grid.

BOEM executed a commercial lease in Virginia, effective November 1, 2013, with Dominion Virginia Power. In addition, BOEM is negotiating two research leases with the Virginia Department of Mines, Minerals, and Energy. The Virginia Department of Mines, Minerals, and Energy has proposed to demonstrate a grid-connected, 12-megawatt offshore wind test facility in an area adjacent to the commercial lease, with construction to be completed in 2017.

In August 2014, BOEM announced three WEAs offshore North Carolina for lease consideration. Before any leases are offered, BOEM will complete an EA to determine potential impacts associated with issuing leases and approving site assessment activities, in accordance with NEPA. BOEM anticipates holding a competitive auction and potentially executing three leases during the next several years, possibly within the 2017–2022 Program implementation timeframe. Any additional renewable energy leasing that may occur during the approximately 50-year lifespan of the producing leases issued during the 2017–2022 Program will need to be coordinated during the later stages of BOEM's oil and gas leasing process, if oil and gas leasing occurs (e.g., lease sale, exploration plan, and development and production plan stages).

12.3.2.1.2. South Atlantic Planning Area

An area off Georgia was nominated under the interim policy for lease related to wind power by Southern Company. Currently, BOEM is considering public comments on its EA before publishing a decision on the deployment of a meteorological tower and/or buoys during a 5-year lease term. Stakeholder discussions continue in South Carolina regarding potential call areas, which are preliminary OCS areas to be analyzed prior to identification as a WEA for commercial development. Planning with respect to renewable energy development in both of these areas is in the early stages, and the prospects are uncertain; however, commercial leasing may proceed during the 2017 to 2022 timeframe (USDOI, BOEM, 2015).

12.3.2.2. Ocean Dredged Material Disposal Sites

There are two ODMDSs off the coast of Virginia, three sites off the coast of North Carolina, three sites off the coast of South Carolina, two sites off the coast of Georgia, and two sites off the coast of Florida that could be impacted from a spill in the South Atlantic Planning Area (USEPA, 2015). These sites are listed in **Table C-76** and their locations are shown in **Figure C-98**.

Table C-76. Ocean Dredged Material Disposal Sites in the South Atlantic Planning Area.

State	Location of ODMDS
Virginia	• Norfolk • Dam Neck
North Carolina	• Morehead City • Wilmington • New Wilmington
South Carolina	• Charleston • Georgetown Harbor • Port Royal
Georgia	• Brunswick Harbor • Savannah
Florida	• Fernandina Beach • Jacksonville

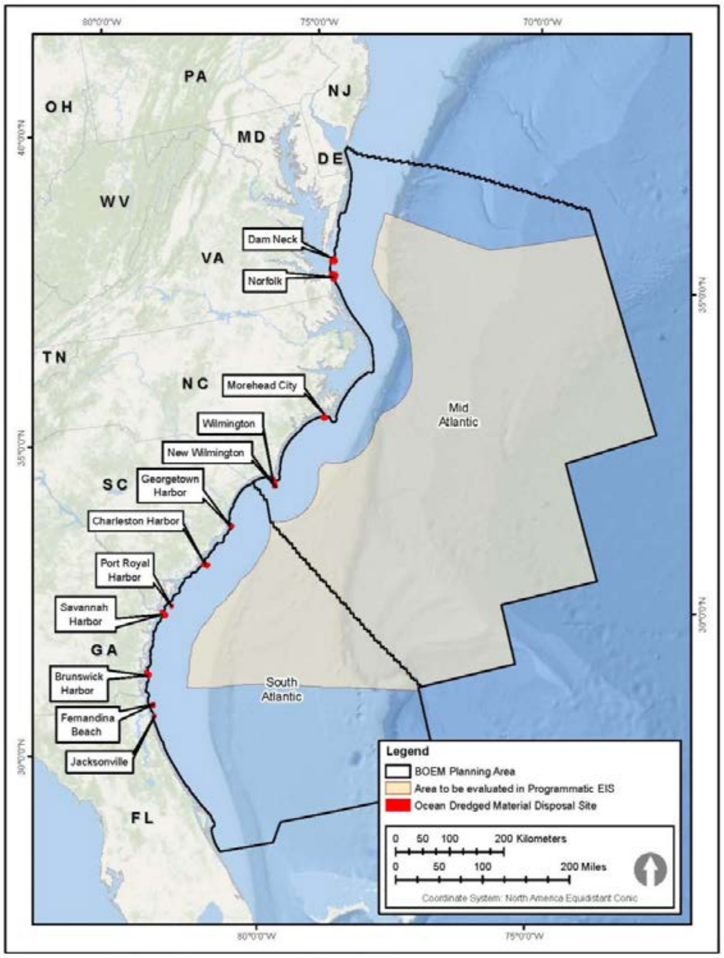


Figure C-98. Offshore Dredged Material Disposal Sites in the Mid-Atlantic and South Atlantic Planning Areas.

12.3.2.3. Military Use Areas

The U.S. Air Force, Navy, Marine Corps, and Special Operations Forces require Military Use Areas, established off all U.S. coastlines, for conducting various testing and training missions. Military activities can be quite varied, but they normally consist of air-to-air, air-to-surface, and surface-to-surface naval fleet training, submarine and antisubmarine training, and Air Force exercises. Military dumping areas also fall into the category of Military Use. Dumping areas can be classified according to whether spoil, ordinance, chemical waste, or vessel waste is deposited in the area.

Military and civilian space program uses of the Atlantic Program Area will increase above the present level due to the ongoing and planned programs. Reasonably foreseeable impact-producing factors associated with military uses include the following:

- Vessel traffic, including associated effluent discharges, air emissions, and noise;
- Aircraft traffic, including associated air emissions and noise;
- Underwater noise from sonars, explosives, and other active acoustic sound sources;
- Seafloor disturbance due to bottom-founded buoys, towers, or other equipment;
- Accidental releases of trash and marine debris (including debris from rocket launches); and
- A risk of fuel spills from military and civilian vessels.

Figure C-99 identifies USDOD operational areas located within the Mid-Atlantic and South Atlantic Planning Areas.

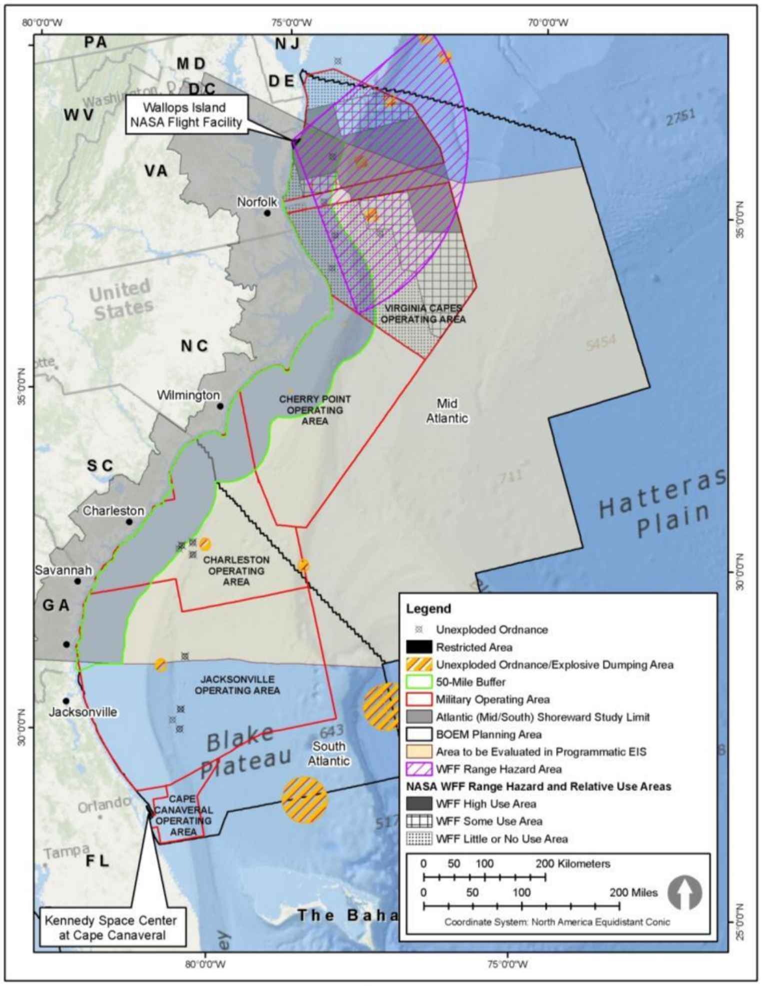


Figure C-99. USDOD Operational Areas within the Mid-Atlantic and South Atlantic Planning Areas.

All oil and gas development activities proposed in sensitive parts of military range complexes or the Wallops Flight Facility (WFF) use areas would include coordination with USDOD and NASA with the appropriate military range complex or command headquarters, or NASA point of contact in order to maximize development while avoiding or minimizing conflicts with potentially hazardous military operations.

Military range complexes and civilian space program use areas, including restricted areas and danger zones, are established in areas off U.S. coastlines to allow military forces to conduct training and testing activities. Most of the Atlantic Program Area is within military range complexes and civilian space program use areas, as shown in **Figure C-99**. Military activities can include various air-to-air, air to-surface, and surface-to-surface naval fleet training, submarine and antisubmarine training, and Air Force exercises. Portions of the area are further defined as danger zones, which can be closed or subject to limited public access during intermittent periods. Danger zones and restricted areas are defined at 33 CFR § 334.2, as described in **Section 12.3.2.3.1**.

The five military-related restricted areas operated by USDOD within the Atlantic Program Area extend from the Chesapeake Bay to Jacksonville, Florida (**Figure C-99**). The Atlantic Fleet Training Virginia Capes (VACAPES) Range Complex extends along the coastlines of Delaware, Maryland, and

North Carolina (U.S. Fleet Forces Command, 2009). Within the VACAPES Range Complex, NASA restricted areas include areas offshore the Goddard Space Flight Center's (GSFC) WFF. The WFF is also home to several critical USDOD programs.

The Cherry Point Complex extends along the coastline of central North Carolina, and the Charleston Complex extends along the coastline of southern North Carolina and South Carolina. The Jacksonville complex extends along the coastlines of Georgia and north Florida to the Merritt Island NWR. The fifth military area is Cape Canaveral OPAREA, which is located along the coastline of Merritt Island (**Figure C-99**). Training exercises include mine, surface, amphibious, and strike warfare involving bombing and missile exercises and mine neutralization. Airborne, surface, and submarine activities are involved. Within the VACAPES Range Complex, five mission impact areas are present that are the debris cones for rocket test and detonations between 2005 and 2007. These areas were showered with debris ranging in size like that of golf balls to small automobiles. In addition, USDOD has examined the compatibility of military activities and oil and gas development and infrastructure and identified areas that they deem incompatible (USDOD, 2010).

Military range complexes and civilian space program use areas are designated for Joint Base Charleston, a combined Air Force and Navy installation in South Carolina, and Parris Island, a marine training facility also in South Carolina. A danger zone is also designated offshore Camp Lejeune, North Carolina.

Three military facilities are located at the Port of Jacksonville: the Naval Submarine Base Kings Bay, Naval Air Station Jacksonville, and Naval Station Mayport; together, these facilities represent the third largest concentration of the U.S. Naval Fleet in the U.S. (World Port Source, 2011). These facilities also make use of offshore military range complexes and civilian space program use areas.

Military and civilian uses of the offshore sea and air areas are compatible, with Navy ships accounting for 3 percent of the total ship presence out to 371 km (200 nmi) (U.S. Fleet Forces Command, 2009). Where naval vessels and aircraft conduct operations that are not compatible with commercial or recreational transportation, they are confined to OPAREAs away from commercially used waterways and inside SUA (U.S. Fleet Forces Command, 2009). Hazardous operations are communicated to all vessels and operators by use of Notices to Mariners issued by the USCG and Notices to Airmen issued by the FAA.

12.3.2.3.1. Danger Zones and Restricted areas

The U.S. Air Force has established multiple surface danger zones and restricted areas. The regulations pertaining to the identification and use of these areas are found in 33 CFR part 334. Units of the USDOD and NASA use surface danger zones and restricted areas in coastal and offshore waters for rocket launching, weapons testing, and conducting a variety of training and readiness operations. The Navy conducts various training activities at sea (e.g., surface target sinking exercises and mine warfare exercises) and shakedown cruises for newly built ships.

Aircraft operated by all USDOD units train within SUA that overlie the OPAREAs, as designated by the Federal Aviation Administration (FAA) (U.S. Fleet Forces Command, 2010). SUAs, also called warning areas, are the most relevant to the oil and gas leasing program because they largely are located offshore, extending from 3 nmi outward from the coast over international waters and in international airspace. These areas are designated as airspace for military activities, but because they occur over international waters, there are no restrictions on nonmilitary aircraft. The purpose of designating such areas is to warn nonparticipating pilots of potential danger. When they are being used for military exercises, the controlling agency notifies civil, general, and other military aviation organizations of the current and scheduled status of the area (U.S. Department of the Navy, 2004). Aircraft operations conducted in warning areas primarily involve air to-air combat training maneuvers and air intercepts, which are rarely conducted at altitudes below 1,524 m (5,000 ft) (U.S. Department of the Navy, 2002).

12.3.2.3.2. USDOD Response to BOEM Planning Areas

On 18 September 2009, the USDOD Principals for the OCS sent an overview letter and interim response describing the Department's OCS study to the Director of BOEM. The information contained in this final report and in the associated geospatial data files provides the USDOD's detailed response to the call for comments on the "Draft Proposed Outer Continental Shelf (OCS) 2010-2015 Oil and Gas Leasing Program." This study identifies locations within six BOEM Planning Areas where there are potential conflicts between testing, training, and other USDOD activities, and offshore oil and gas development. Most of these potential conflicts are attributable to the frequent use of live munitions in support of fleet gunnery exercises; air-to-surface bombing; and anti-submarine warfare and test operations. Note that the results of this USDOD study are for oil and gas activity and infrastructure only and do not necessarily apply to offshore renewable energy activities or infrastructure.

Methods and Results: Analysis of USDOD Activities and Compatibility with Oil and Gas Resource Development on the OCS

The USDOD used a comprehensive approach for its analysis of activities on the OCS. Four categories of potential compatibility were developed as part of this analysis:

- Unrestricted: No USDOD-requested restrictions on oil and gas infrastructure or related activities. However, USDOD requests early and prior coordination if oil and gas activity is contemplated in these areas.
- Site Specific Stipulations: Areas where, with specific stipulations, above-surface oil and gas infrastructure may be feasible. Examples of currently used stipulations include: "hold harmless" provisions; electromagnetic emission controls; site evacuation protocols; location pre-coordination; density limitations; and planned periods of lease operations. **Section 12.3.2.3.3**, provides further details on examples of OCS lease stipulations.
- No Permanent Oil and Gas Surface Structures: Areas where subsurface oil and gas infrastructure may be compatible; e.g., where scheduled temporary surface activities from a drillship or moveable platform are pre-coordinated with USDOD and subsurface and seafloor infrastructure remains in place.
- No Oil and Gas Activity: Areas where any oil and gas development infrastructure and activity would jeopardize USDOD operations. USDOD assessed each OCS Operating Area/Warning Area using these four categories and the assessment and entered results into a GIS database. The geospatial data integrates OPAREAs and Warning Areas, along with USDOD offshore activities with BOEM Planning Areas and the 2017-2022 DPP Program Areas. The GIS shapefiles with these data were transmitted to BOEM and illustrated in Figure 3.6-7 of the Programmatic EIS

The USDOD analysis of its offshore activities using the four categories above and aggregated for the 26 BOEM OCS Planning Areas results in the following:

- Unrestricted: 57 percent
- Site Specific Stipulations: 40 percent
- No Permanent Oil and Gas Surface Structures: 2 percent
- No Oil and Gas Activity: 1 percent

This report focuses on the six BOEM Planning Areas where USDOD has determined that its offshore activities are not compatible with oil and gas activities and infrastructure. Information on areas where USDOD would request Site-Specific Stipulations or No Permanent Oil and Gas Surface Structures is contained in the geospatial data and depicted on the Planning Areas, USDOD OPAREAs maps. The USDOD analysis and this report do not address offshore renewable energy.

The six BOEM Planning Areas with operating areas determined to be No Oil or Gas Activity are reflected in the Planning Areas USDOD OPAREAs maps. The information is based on current use of the OCS by USDOD and does not reflect future or unforeseen requirements such as new capabilities, surge events, and contingency use. As such, this report is a snapshot of USDOD activities on the OCS at the time of the study.

No Oil or Gas Activity

- VACAPES OPAREAs (North and South)
- Cherry Point OPAREA
- Charleston OPAREA
- Jacksonville OPAREA
- South of Jacksonville OPAREA
- Key West OPAREA

12.3.2.3.3. Guidance for Military Coordination

On February 1, 2013, BOEM met with representatives of the USDOD to discuss pre-notification for BOEM-permitted geological and geophysical (G&G) activities (oil and gas) or G&G activities authorized by an OCS plan or negotiated renewable energy and marine minerals lease within the Mid-Atlantic and South Atlantic Planning Areas. The armed services expressed no fundamental objections with respect to the compatibility of the G&G activity required for oil and gas resource development on the OCS and the operations conducting by USDOD within their Atlantic range complexes (**Figure C-99**) (USDOD, 2010). The proposed action at issue was limited to G&G activity and BOEM sought to acquaint USDOD with the impacting factors for such activity and to discuss them in relation to USDOD operations. The USDOD (2010) composed stipulations for an OCS lease sale in areas where USDOD activities currently take place.

Stipulation No. 1 – Evacuation

(a) The permittee or authorized operator, recognizing that oil and gas resource exploration, renewable energy development, or marine mineral development may occasionally interfere with military testing, training, and operations, hereby recognizes and agrees that the U.S. reserves and has the right to temporarily suspend operations and/or require evacuation of an area where BOEM permitted or authorized activities may be scheduled or underway in the interest of national security. Every effort will be made by the appropriate military agency to provide as much advance notice as possible of the need to suspend operations and/or evacuate. Advance notice of 14 days shall normally be given before requiring a suspension or evacuation, but in no event will the notice be <4 days. Temporary suspension of operations may include the evacuation of personnel, and appropriate sheltering of personnel not evacuated. Appropriate shelter shall mean the protection of all personnel for the entire duration of any USDOD activity from flying or falling objects or substances and will be implemented by a written order from the BSEE Regional Supervisors, after consultation with the appropriate command headquarters or other appropriate military agency, or higher authority. The appropriate command headquarters, military agency or higher authority shall provide information to allow the lessee to assess the degree of risk to, and provide sufficient protection for, lessee's personnel and property. Such suspensions or evacuations for national security reasons normally will not exceed 72 hours; however, any such suspension may be extended by order of BSEE. Upon cessation of any temporary suspension, the BSEE will immediately notify the lessee such suspension has terminated and operations on the permitted or authorized area can resume.

(b) The permittee or authorized operator shall inform the BSEE of the persons/offices to be notified to implement the terms of this stipulation.

(c) The permittee or authorized operator is encouraged to establish and maintain early contact and coordination with the appropriate command headquarters, in order to avoid or minimize the effects of conflicts with potentially hazardous military operations.

(d) The permittee or authorized operator shall not be entitled to reimbursement for any costs or expenses associated with the suspension of operations or activities or the evacuation of property or personnel in fulfillment of the military mission in accordance with subsections (a) through (c) above.

(e) Notwithstanding subsection (d), the permittee or authorized operator reserves the right to seek reimbursement from appropriate parties for the suspension of operations or activities or the evacuation of property or personnel associated with conflicting commercial operations.

Stipulation No. 2 – Coordination

(a) The placement, location, and planned periods of operation by the permittee or authorized operator are subject to approval by the BOEM Regional Director (RD) after the review of an operator's exploration plan (EP). Prior to approval of the permit or issuance of the authorization the operator shall consult with the appropriate command headquarters regarding the location, density, and the planned periods of operation to minimize conflicts with USDOD activities. When determined necessary by the appropriate command headquarters, the permittee will enter into a formal Operating Agreement with such command headquarters that delineates the specific requirements and operating parameters for a particular action. If it is determined that the Final operations will result in interference with scheduled military missions in such a manner as to possibly jeopardize the national defense or to pose unacceptable risks to life and property, then BOEM may approve the permit or issue the authorization with conditions, disapprove it, or require modification in accordance with 30 CFR part 550. The RD will notify the lessee in writing of the conditions associated with plan approval, or the reason(s) for disapproval or required modifications. Moreover, if there is a serious threat of harm or damage to life or property, or if it is in the interest of national security or defense, pending or approved operations may be suspended in accordance with 30 CFR 550. Such a suspension may extend the term of a permit by an amount equal to the length of the suspension, except as provided in 30 CFR 550.169(b), or BOEM may require a new permit or authorization to be issued to the operator. The BOEM RD will attempt to minimize such suspensions within the confine of related military requirements.

(b) The permittee or authorized operator is encouraged to establish and maintain early contact and coordination with the appropriate command headquarters, in order to avoid or minimize the effects of conflicts with potentially hazardous military operations.

(c) If national security interests are likely to be in continuing conflict with an existing operating agreement, the BOEM RD will direct the lessee to modify any existing operating agreement or to enter into a new operating agreement to implement measures to avoid or minimize the identified potential conflicts.

Stipulation No. 3 – Electromagnetic Emissions

The permittee or authorized operator agrees to control its own electromagnetic emissions and those of its agents, employees, invitees, independent contractors or subcontractors emanating from individual designated defense operating areas, warning areas, and water test areas in accordance with requirements specified by the commander of the command headquarters to the degree necessary to prevent damage to, or unacceptable interference with, USDOD flight testing, training, or operational activities, conducted within individual designated defense operating areas, warning areas, and water test areas. Prior to entry into the particular operating area, warning area, or water test area, the permittee or authorized operator, its agents, employees, invitees, independent contractors or subcontractors, must coordinate electromagnetic emissions with the appropriate command headquarters.

12.3.2.4. NASA Use Areas

NASA operates one facility in the Atlantic Program Area: WFF at Wallops Island, Virginia (**Figure C-99**). Information regarding military use areas is presented in **Section 12.3.2.3**.

The WFF Main Base is located on the Eastern Shore of Virginia on the Delmarva Peninsula approximately 5 mi (8 km) west of Chincoteague, Virginia; approximately 90 mi (140 km) north of Norfolk, Virginia, and 40 mi (64 km) southeast of Salisbury, Maryland. The WFF consists of three separate parcels of land totaling 6,200 ac (25 km^2): the Main Base, the Mainland, and the Wallops Island Launch Site. The Mainland and the Wallops Island Launch Site are approximately 7 mi (11 km) southeast of the Main Base. Wallops operates controlled airspace with FAA qualified Air Traffic Controllers including:

- The WFF Airport Control Zone to 2,500 ft (760 m) within a 5-mi (8-km) radius of the airport;
- Restricted Area R-6604, connecting WFF airspace and offshore warning areas; and
- WFF Authorized Space.

The authorized space includes the following restricted areas:

- The GSFC/WFF Airport Control Zone: Airspace vertically to 2,500 ft in a 5-mi radius of the airport. The Control Zone has an arrival and departure corridor.
- Restricted Area R-6604: Restricted airspace connecting WFF and offshore warning areas is available 24 hours a day, 7 days a week unconditionally, to unlimited altitude.
- VACAPES Warning Areas and International Waters: Mission/project activity requiring surface area and restricted airspace extending outside of R-6604 into the VACAPES warning areas and international waters are available 24 hours a day, 7 days a week unconditionally to unlimited altitude with clearance and approval by responsible agencies (e.g., the FAA and USN Fleet Area Control and Surveillance Facility).

NASA also has designated danger zones and restricted areas for rocket testing and shuttle launches. The NASA restricted areas within the Mid-Atlantic and South Atlantic Program Areas include offshore Wallops Island in Virginia and offshore the Kennedy Space Center at Cape Canaveral. The limits of the areas are established offshore of the facilities and have restricted access during rocket and shuttle launch activities (33 CFR § 334.525).

Over the 2017-2023 time period of this Programmatic EIS, it is assumed that NASA also has designated downrange danger zones and has identified patterns for recent debris cones from rocket tests that represent hazards for surface activities after such tests. There also are restricted areas for rocket testing, satellite launches, and other range mission activities. NASA restricted areas within the Atlantic Program Area include an area offshore the GSFC's WFF in Virginia. NASA's GSFC owns and operates the launch range at the WFF. NASA is expected to continue to conduct science, technology, and educational flight projects from WFF aboard rockets, balloons, and unmanned aerial vehicles using Atlantic waters for operations on an almost daily basis.

Since 2006, launches from WFF have grown in number and importance to U.S. space and national defense priorities and programs. The WFF is one of the Nation's few launch ranges to support medium to large vehicle class satellite launches. Orbital ATK of Virginia selected WFF, including the Mid-Atlantic Regional Spaceport (MARS), as its preferred site to develop and launch its *Antares* rocket. MARS is a Virginia and Maryland sponsored spaceport whose mission is to foster regional economic development through aerospace projects and commercial space launch operations conducted from their property on the WFF Research Range. According to NASA, Orbital ATK foresees an average of five MARS-associated launches a year beginning in 2011 using the *Antares* rocket. In addition, Orbital ATK has been selected by NASA to conduct launches from WFF for ongoing commercial cargo re-supply services for the International Space Station.

NASA will depend on commercial re-supply for reliable, safe and cost effective cargo delivery services to the station. The contract is for launch services, orbital rendezvous and berthing with a crewed spacecraft, delivery of internal and/or external cargo, unberthing and de-orbit, and disposal or return of internal cargo from 2011 through 2017. Planned flights from WFF include NASA scientific satellites with a lunar reconnaissance mission in 2012, Lunar Atmospheric and Dust Experiment Explorer, as the first planned Expendable Launch Vehicle mission from WFF to support the Nation's scientific program goals. The WFF tenants such as the Navy's Surface Combat System Center and Naval Air Warfare Center-Aircraft Division also rely on the WFF Research Range for aircraft and shipboard system development testing and training. The U.S. Air Force also relies on launches from WFF to support two critical programs: Operationally Responsive Space, and the Tactical Satellite Program. Future missions in these programs are on schedule for launch from WFF in 2011 and beyond. The Missile Defense Agency also relies on launches from WFF for suborbital targets to train the Navy fleet, and orbital technology development programs including the Near Field Infrared Experiment.

13.0 COMMERCIAL AND RECREATIONAL FISHERIES

13.1. ALASKA PROGRAM AREA

13.1.1. Beaufort Sea and Chukchi Sea Planning Areas

Fisheries in the Beaufort and Chukchi Seas include commercial, recreational, and subsistence fishing. These three fishery types are discussed in the following section.

13.1.1.1. Commercial Fisheries

The most recent FMP is from 2009 (NPFMC, 2009). The offshore waters of the Arctic Management Area, which consist of the U.S. EEZ of the Beaufort and Chukchi Seas from 3 nmi (5.6 km) offshore, is currently closed to commercial fishing (NPFMC, 2009). There is one quasi-commercial fishery operating during the summer in Alaskan state waters at the mouth of the Colville River that targets *Coregonus* spp. using coastal set nets. The market for these fish is local, although some whitefish have been marketed in the Barrow and Fairbanks areas. There is also a commercial chum salmon fishery annually in the summer and fall within Kotzebue Sound (Chukchi Sea) (NPFMC, 2009; USDOI and BOEM, 2011). Salmon are sold locally and some are shipped to other markets outside the region (NPFMC, 2009).

Commercial fishing in the Beaufort Sea and Chukchi Sea Planning Areas may open depending on changing ecological conditions. For example, warming ocean temperatures, loss of seasonal sea ice, and other long term changes in the Arctic marine ecosystem may allow for this fishery to open (NPFMC, 2009). The FMP identified three species as potential commercial target species: Arctic cod, saffron cod, and snow crab (*Chionoecetes opilio*). There is some indication that other commercially harvested species may expand northward (e.g., walleye pollock, and yellowfin sole [*Limanda aspera*]) (USDOC, NMFS, 2009b). Consequently, in the coming decades, commercially viable populations of fish and shellfish may develop in the Arctic but development of a fishery in federal waters depends on federal approval.

Commercial Landings

There are no recent catch data for commercial fishing. Zeller et al. (2011) analyzed the total commercial and subsistence catches by Alaskan coastal communities between 1950 and 2006. Commercial and subsistence catch are not separated in this report. Average catch of chum salmon was between 1,500 and 2,000 tons/yr and whitefishes and Dolly Varden char accounted for approximately 100 to 300 tons/yr in the Chukchi Sea. Total fish catch in the Beaufort Sea declined from 80 tons per year in the early 1990s to approximately 40 tons per year in 2006, and was dominated by Arctic cisco (*Coregonus auyumnalis*), broad whitefish (*C. nasus*), and Dolly Varden char (Zeller et al., 2011). The number of commercially caught Arctic Cisco in the Colville River from 1967 to 2003 was between approximately 5 and 180 fish/day (MBC Applied Environmental Sciences, 2004; ABR, Inc., 2007).

13.1.1.2. Recreational Fisheries

There is little data on recreational fishing in the Beaufort and Chukchi Seas and little data are available to determine the trends in landings for subsistence and recreational fisheries in the Arctic Management Area (NPFMC, 2009). There are few recreational fisheries in the Arctic Management Area, including no catch and release FMPs.

13.1.1.3. Subsistence Fisheries

Personal use fisheries, or subsistence fishing, probably occurs occasionally in EEZ waters. In additional to subsistence fisheries, there also may be some “sport” fishing activity near Kotzebue or Barrow. Most of the catch in the Arctic likely occurs in state waters and would fall under the classification of sport, subsistence, or personal use fisheries, which are fisheries regulated by the State of Alaska.

Subsistence fishing is an important part of the economic, nutritional, and cultural lifestyle of local residents of the Arctic (NPFMC, 2009). Fishing activities occur near human settlements of Wainwright, Barrow, Nuiqsut, and Kaktovik, by residents of villages in this region. Fishing also occurs in all nearshore areas during open water seasons and to a limited extent in this area during winter. Fishing is generally conducted by gill nets threaded through holes in the ice or by jigging in winter, and by rod and reel, gill net, and jigging in summer. Species harvested by subsistence fishers include Pacific herring, Dolly Varden char, whitefishes, Arctic and saffron cod, and sculpins (NPFMC, 2009).

Subsistence Landings

There are no recent catch data for subsistence fishing in the Arctic region. Available catch data is from fish within Colville River delta. The under-ice subsistence fishery yielded an average of 19,200 lb (8,743 kg) of Arctic cisco annually between 1985 and 2003 (Moulton and Seavey, 2003). The number of fish caught by subsistence fishers in the Colville River from 1985 to 2003 was <40/day (MBC Applied Environmental Sciences, 2004). The number of fish caught by Barrow area subsistence fishers was 28,683 total whitefish (61,149 lb), 788 total salmon (4,638 lb), and 10,351 total other coastal fish (capelin [*Mallotus villosus*], rainbow smelt [*Osmorus mordax*], Arctic cod, tomcod [*Microgadus tomcod*], and sculpin: 2,090 lb) (Stephen R. Braund & Associates, 2010).

13.1.2. Cook Inlet Planning Area

13.1.2.1. Commercial Fisheries

Cook Inlet supports several important commercial fisheries. The NMFS Statistics Division has automated data summary programs that can be used to rapidly and easily summarize U.S. commercial fisheries landings from each state (USDOC, NMFS, 2015). The commercial landings cannot be separated by region, thus, several other published Fisheries Management Reports for the Cook Inlet were used for this section. There is little data on the socioeconomic impact of the commercial fisheries in Cook Inlet (e.g., number of jobs, landings revenue, or income). Russ et al. (2013) indicated the commercial value of several groundfish species in Cook Inlet in 2011, for example, sablefish (*Anoplopoma fimbria*) ($260,000), rockfish ($41,000), lingcod (*Ophiodon elongatus*) ($7,000), Pacific cod (*Gadus macrocephalus*) ($2 billion), and pollock ($1,000). Shields and Dupuis (2015) indicated the value of salmon and other species in Upper Cook Inlet (UCI), for example, sockeye (*Oncorhynchus nerka*) ($33 billion), pink ($588,197), chum ($686,954), coho (*O. kisutch*) ($777,431), and chinook (*O. tshawytscha*) ($206,119), herring ($58,000), smelt (approximately $200,000), and razor clams ($260,000), which are harvested at Polly Creek on the west side of Cook Inlet.

13.1.2.1.1. Commercial Landings

Commercial fisheries target several key finfish and invertebrate species in Cook Inlet. Cook Inlet can be divided into the UCI and Lower Cook Inlet (LCI) (Russ et al., 2013; Hollowell et al., 2015; Shields and Dupuis, 2015). The LCI consists of waters west of Cape Fairfield, north of Cape Douglas, and south of Anchor Point. The UCI consists of waters north of Anchor Point. Finfish species include Pacific herring, eulachon (*Thaleichthys pacificus*), smelt, and several groundfish such as sablefish, Pacific cod, walleye pollock (*Gadus chalcogrammus*), lingcod, and rockfish (mainly black rockfish [*Sebastes melanops*]) (Russ et al., 2013; Shields and Dupuis, 2015). In the UCI and LCI, five salmon species are of commercial importance and include pink, sockeye, chum, coho, and Chinook salmon (Hollowell et al., 2014; Shields and Dupuis, 2015). Commercially important invertebrates include Dungeness crab, shrimp, weathervane scallops, razor clams, blue mussels, and several miscellaneous species, including *Octopus dofleini*, green urchin, and sea cucumber (Trowbridge and Goldman, 2006).

In 2011, the salmon harvest (number of fish) in the LCI was composed of 272,659 sockeye (44.0 percent), 271,518 pink (43.8 percent), 73,515 chum (11.9 percent), 1,462 coho (0.2 percent), and 368 Chinook (<0.1 percent) for a total harvest of 619,522 fish (Hollowell et al., 2015). In 2011, the salmon harvest (number of fish) in the UCI was mainly composed of sockeye salmon (95 percent) (Shields and Dupuis, 2015). In 2014, the salmon harvest in the UCI was composed of 2,343,032 sockeye (72.2 percent), 642,754 pink (19.8 percent), 116,083 chum (3.6 percent), 137,200 coho (4.2 percent), and 4,660 Chinook (0.1 percent) for a total harvest of 3,243,729 fish (Shields and Dupuis, 2015). In 2011, total harvest of rockfish species was 66,432 lb, lincod was 10,442 lb, sablefish was 57,350 lb, Pacific cod was 778,857 lb, and pollock was 5,751 lb (Russ et al., 2013). A total of 348,294 lb of razor clams and 29 tons of herring were commercially harvested in 2014 (Shields and Dupuis, 2015).

13.3.2.1.2. Commercial Fishing Gears

There is an assortment of gear and fishing methods used in Cook Inlet, including gill nets, seines, purse seines, trawls, dredges, dip nets, pots, jigs, and/or diving equipment (Shields and Dupuis, 2015). Salmon are harvested primarily using drift gill nets, but set gill nets and seines also have been used since 1982. Gillnets are the only gear legally used to harvest herring in the UCI, however, other gear such as trawl, seine, or gill nets may be used in other areas. Herring sac roe may be harvested using seine, purse seine, or gill net gear (Hallowell et al., 2014). Smelt are harvested primarily using dip nets, razor clams typically are collected by hand principally from the Polly Creek and Crescent River sandbar areas, and other bivalves may be harvested using dredging gear (Shields and Dupuis, 2015). Gear types used for groundfish collection/harvesting include longline, pelagic trawls, hand trolls (hand jig), mechanical jig, and pots (Russ et al., 2013). In general, groundfish fisheries in the U.S. EEZ (3 to 200 nmi offshore) fall under federal authority, while the State of Alaska manages groundfish within state territorial (0 to 3 nmi) waters (Trowbridge et al., 2008). The ADFG, Division of Commercial Fisheries, manages all commercial groundfish fisheries in Cook Inlet, where groundfish are typically harvested in the LCI Management Area.

13.3.2.1.3. Commercial Fishing Locations and Seasons

Commercial fishing seasons in these areas for salmon are species-specific and vary with each year. Smelt season is from May 1 to June 30. Various announcements, restrictions, and closures for the Cook Inlet commercial fisheries are available at ADFG (2015).

13.3.2.1.4. Time and Area Closures and Gear Restrictions

Set gill nets are the only gear permitted in the Northern District (a portion of the UCI), and seine gear is restricted to Chinitna Bay Subdistrict (Shields and Dupuis, 2015). For herring, gillnet restrictions include having mesh sizes no smaller than 2 in. and no greater than 2.5 in. (Shields and Dupuis, 2015). Over the last decade, the abundance of Pacific herring has been stable, but historically very low. According to Hollowell et al. (2015) there are two current restrictions for herring fishing. The Southern, Outer, and Eastern Districts of the LCI are closed to commercial herring (5 AAC 27.463). Sac roe fishing in Kamishak Bay has been closed to commercial fishing since 1999, and management plans have been developed to allow for sustainable harvest in the area (e.g. 5 AAC 27.465) however, nothing has been approved (Hallowell et al., 2012). Smelt may be collected in salt water between May 1 and June 20 in Cook Inlet between Chuitna River and Little Susitna River (Shields and Dupuis, 2015). The east side of Cook Inlet is set aside for sport harvesting of razor clams and the west side of Cook Inlet is where razor clams are commercially harvested (Shields and Dupuis, 2015). Cook Inlet historically supported king crab, Dungeness crab, and shrimp fisheries, but these fisheries currently are closed while stocks rebuild (Trowbridge and Goldman, 2006).

13.1.2.2. Recreational Fisheries

Recreational fish species primarily include five salmon species (sockeye, pink, chum, coho, and Chinook), Pacific halibut, rockfish species, and lingcod (Kirkvliet et al., 2013). Recreationally fished invertebrates include razor, littleneck, and butter clams. Dungeness crab, tanner crab, red king crab, and shrimp are recreational species, but these are closed due to low stock abundance. Other invertebrates such as blue mussels, cockles, softshell clams, tritons, sea urchins, and sea cucumbers are harvested in small amounts (Kirkvliet et al., 2013).

13.1.2.2.1. Recreational Landings

In 2012, the number of recreational fishing days in the LCI was 209,677, which accounts for 11.1 percent of the total number of recreational fishing days in Alaska (Kirkvliet et al., 2013). Approximately 80 percent of the recreational fishing days were spent collecting saltwater fish. In 2012, the number of fish harvested in Cook Inlet was 189,986 halibut, 6,977 Chinook salmon, 11,208 coho salmon, 260,857 razor clams at 12 per person per day, 23,406 little neck and butter clams, 2,451 other shellfish species, approximately 18,000 rockfish, and 5,543 lingcod. The economic value of rockfish and lingcod is unknown and much of the rockfish and lingcod harvest is incidental to halibut fishing, thus, their economic values are not separable (Kirkvliet et al., 2013).

13.1.2.2.2. Recreational Fishing Gear

Chinook and other salmon are fished through trolling, coho are fished by trolling or jigging (Kirkvliet et al., 2013). Razor and other clams are hand-collected only.

13.1.2.2.3. Recreational Fishing Locations and Seasons

Most recreational saltwater fishing in Cook Inlet occurs from April to September. Chinook salmon are mostly fished from April to August, but there is a winter season between October and March (Kirkvliet et al., 2013). The halibut fishery is mainly between May and September. Razor clams are collected along an 80.5 km (50-mi) stretch of sandy beach on the east side of Cook Inlet, between the

Kasilof River and Anchor River. There is no closed season for razor clams, but winter weather precludes most digging between October and February (Kirkvliet et al., 2013). Littleneck and butter clams are collected in the intertidal zone, primarily along beaches of the LCI.

13.1.2.2.4. Time and Area Closures and Gear Restrictions

Kirkvliet et al. (2013) reviews several restrictions to recreational fishing in Cook Inlet, however, these are species and area specific, and have varied by year. For example, Chinook fishing gear has been restricted to single hook since 2013. There are few seasonal restrictions for recreational fishing in Cook Inlet.

13.2. GULF OF MEXICO PROGRAM AREA

13.2.1. Commercial Fisheries

The states within the Gulf of Mexico Program Area that are covered under this Programmatic EIS include Texas, Louisiana, Mississippi, and Alabama (Figure 2.1-2 in the Programmatic EIS). Only a small portion of the Eastern Planning Area is being considered under this Programmatic EIS. As such, west Florida commercial fisheries generally are not discussed in this section.

The Gulf of Mexico supports regionally and nationally important commercial fisheries. The NMFS Statistics Division has automated data summary programs that can be used to rapidly and easily summarize U.S. commercial fisheries landings (USDOC, NMFS, 2015). For the purposes of this Programmatic EIS, it is not practicable to report specific fisheries landings using the statistics queries due to the caveat that data are updated weekly; therefore this characterization of commercial fisheries is primarily summarized from the most recently published Fisheries Economics Report (USDOC, NMFS, 2014).

In 2012, the seafood industry in the four coastal states adjacent to the Gulf of Mexico Program Area supported nearly 78,000 jobs (**Table C-77**). Commercial fisheries support not only numerous jobs directly related to fisheries (e.g., fishing crews) but also many jobs that are indirectly related to fishing such as seafood distributors, restaurants, and suppliers of commercial fishing gear. Because the fishing industry is so integrated with local business, commercial fishing ports often support entire coastal fishing communities, and are important components of the Gulf of Mexico economy. In 2012, the Gulf of Mexico region's seafood industry generated $5.3 billion in sales, with Texas and Louisiana generating $2.5 billion and $1.9 billion of that total, respectively. Texas generated the largest income ($677 million) and value added impacts ($1 billion). Louisiana generated the highest revenue ($331 million) and number of jobs (approximately 33,000).

Table C-77. Economic Impacts of the Gulf of Mexico Region Seafood Industry (Thousands of Dollars) in 2012 (From: USDOC, NMFS, 2014).

State	Revenue	Number of Jobs	Sales	Income	Valued Added
Alabama	$46,340	9,947	$460,514	$172,314	$229,316
Louisiana	$331,165	33,391	$1,927,986	$659,974	$920,873
Mississippi	$49,295	8,532	$377,374	$149,147	$193,349
Texas	$194,044	25,911	$2,499,832	$677,391	$1,036,657
Total	**$620,844**	**77,781**	**$5,265,706**	**$1,658,826**	**$2,380,195**

13.2.1.1. Commercial Landings

Table C-78 shows commercial landings in thousands of pounds of key species or species groups within the four Gulf of Mexico states, including blue crab, groupers, menhaden, mullets, oysters, red snapper, shrimp, crawfish, and tunas (USDOC, NMFS, 2014). Fishers in these four states landed

1.59 billion pounds of finfish and shellfish in 2012. This was a 4.6 percent increase from the 1.52 billion pounds landed in 2003 and a 6.3 percent decrease from the 1.69 billion pounds landed in 2011. Finfish landings contributed 82.5 percent of total landings in the four Gulf of Mexico states (1.31 billion pounds) in 2012.

Commercial fisheries in the Gulf of Mexico Program Area target a variety of fish and invertebrate species in both state and federal waters. It is important to emphasize landings data do not indicate actual areas where particular species were caught. To interpret fishing activity within the Program Area from landings data for the coastal states accurately, inferences must be made using knowledge of broad habitat use by species represented in the data set. For example, 2012 landings data (**Table C-78**) indicate that blue crab is an important fishery species (50.3 million pounds), but blue crabs live primarily in inshore waters and would not be part of the fisheries in the Gulf of Mexico Program Area. The eastern oyster (*Crassostrea virginica*) provides a similar example of an inshore species making substantial contributions to landings data that should not be used to characterize fisheries in the Program Area.

Table C-78. Total Landings and Landings of Key Species/Species Groups (Thousands of Pounds) (From: USDOC, NMFS, 2014).

Key Species/ Species Group	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Blue crab	56,735	52,498	42,672	58,871	51,855	46,597	57,907	35,481	48,773	50,349
Grouper	416	329	303	220	141	170	208	144	190	211
Menhaden	1,142,692	1,023,167	815,417	901,366	1,005,273	927,478	1,165,843	966,954	1,374,069	1,275,585
Mullet	6,318	7,015	3,313	5,340	3,243	3,548	2,065	1,623	2,740	3,437
Oysters	25,280	23,408	18,757	17,280	19,559	18,153	19,955	13,661	15,642	17,759
Red snapper	3,507	3,866	3,524	3,988	2,079	1,520	1,640	1,942	2,030	2,349
Shrimp	238,226	237,524	196,994	274,798	216,535	178,847	240,621	166,009	209,494	202,555
Crawfish*	8,337	8,537	15,177	1,469	15,848	15,612	19,312	14,557	9,599	6,815
Tuna	3,459	3,230	2,408	2,143	2,476	1,270	2,054	491	933	2,152
Finfish Total	**1,187,119**	**1,069,105**	**851,377**	**939,081**	**1,040,677**	**958,909**	**1,196,287**	**992,210**	**1,406,153**	**1,311,858**
Shellfish Total	**329,615**	**322,140**	**273,787**	**352,478**	**303,846**	**259,238**	**337,868**	**229,765**	**283,582**	**277,556**
Total Landings	**1,516,733**	**1,391,245**	**1,125,164**	**1,291,559**	**1,344,523**	**1,218,147**	**1,534,154**	**1,221,974**	**1,689,735**	**1,589,413**

*All landings from Louisiana.

13.2.1.2. Commercial Fishing Gears

The main commercial fishing gears used within the Program Area and along the Gulf of Mexico coast are bottom trawls, purse seines, gill nets, pots/traps, and bottom and pelagic longlines. **Table C-79** provides the species sought, seasons, and general areas fished with each gear type.

Bottom trawls are large bag-shape nets constructed with natural fibers or synthetic materials that are rectangular or polygonal in shape (mouth openings). Trawls are towed at specific water depth (surface, mid-water, or bottom), depending on the target species. Trawls are classified by their function, bag construction, or method of maintaining the mouth opening (Stevenson et al., 2004). Bottom trawls are designed to be towed along the seafloor to catch a variety of demersal fish and invertebrate species (e.g., shrimps, Gulf flounder [*Paralichthys albigutta*], or Atlantic croaker).

Purse seines or encircling nets are a type of net constructed with natural fibers or synthetic materials that are used to encircle a school of fish. Once the net has captured a school of fish, it is then cinched. Purse seines are primarily used to target Gulf menhaden (*Brevoortia patronus*) on the inner shelf of the Gulf of Mexico Program Area during spring and summer months.

Gill nets are constructed of long panels of monofilament netting (mesh size: 3 to 4 in.) with lead line at the bottom and float line at the surface. Nets are set perpendicular to shore or encircling a target school of fish. Gill nets are used to catch Spanish mackerel, mullet, black drum (*Pogonias cromis*), and other coastal species by entanglement in coastal waters offshore Louisiana, Mississippi, and Alabama; gill nets are prohibited in Texas.

Pot or traps are rectangular, square, or cylindrical enclosed devices with one or more gates or entrances set on the bottom to target benthic invertebrates (e.g., blue crab and deepsea red crab). Pots/traps are usually marked at the surface with a buoy (float) that is attached to the pot or trap by a rope. This type of gear is usually set in strings near natural or artificial structure or hard bottom. Pots are connected by "mainlines" that either float off the bottom or sink to the bottom (Stevenson et al., 2004). This method is primarily used in estuarine, inshore, and shelf waters.

Longlines typically consist of 1.6 to 64.4 km (1 to 40 mi) of monofilament mainline with leaders attached to baited hooks (gangions) clipped on at regular predetermined intervals. The mainline is attached to a series of floats equipped with radar reflectors and with radio beacons at regular intervals. Longlines are classified by where the gear is set in the water column. Longline gear is set either at the surface in open waters of the Gulf of Mexico or on the bottom in outer shelf waters from Florida to Texas on suitable bottom type. Longlines either drift with the currents or are stationary (anchored to the bottom) and are used to target benthic species (e.g., tilefish and large coastal sharks), coastal pelagic species (e.g., dolphinfish and wahoo), or pelagic species (e.g., tunas, swordfish, or pelagic sharks) (Stevenson et al., 2004).

13.2.1.3. Commercial Fishing Locations and Seasons

Commercial landings can show seasonal patterns in fish abundance or the effects of legislative closures, but do not provide actual locations of fishing activity. Such information must be inferred from species-specific habitat preferences and the particular gear used. For example, yellowfin tuna are caught with surface longlines fishing beyond the continental shelf, and red snapper are caught with hook-and-line near reefs or other structures in inner and middle shelf waters. **Table C-79** summarizes this information for key species or species groups targeted in the Gulf of Mexico.

Table C-79. Primary Commercial Fishing Methods, Species Sought, Seasons, and General Areas Fished in the Gulf of Mexico.

Fishing Method	Species Sought	Primary Fishing Season	Primary Fishing Area
Bottom trawling (including skimmer nets)	Brown shrimp, pink shrimp, white shrimp, seabob, royal red shrimp, and groundfish	Year-round depending on species and seasonal closures	Soft bottom, shelf waters from nearshore to the upper slope off all states bordering the GOM depending on closed areas
Purse netting	Menhaden, butterfish, scads, blue runner, and Spanish sardines	Spring and summer months	Menhaden inner shelf off Louisiana and Mississippi
Gillnetting	Coastal sharks, mullet, Spanish mackerel, black drum	Spring and summer depending on species and seasonal closures	Coastal waters, Alabama, Mississippi, Louisiana, prohibited in Texas
Hook-and-lining (bottom fishing and trolling)	Snappers, groupers, amberjacks, triggerfishes, sharks, king mackerel, Spanish mackerel, and cobia	Year-round; effort varies with species-specific closures	Oil platforms, artificial reefs, and natural hard bottom areas throughout the GOM – most activity on the inner and middle shelf
Surface longlining	Sharks, swordfish, tunas, and dolphinfish.	Year-round with summer peaks	Open GOM seaward of 200 m (656 ft)
Bottom longlining	Groupers, snappers, tilefishes, and sharks	Year-round; effort varies with species-specific closures	Outer shelf waters from Florida to Texas on suitable bottom type
Trapping	Blue crab, deepsea red crab, and reef fishes	Blue crab (year round); spiny lobster (July to March); fish (year round)	Estuarine, inshore coastal, and shelf waters

GOM = Gulf of Mexico.

13.2.1.4. Time and Area Closures and Gear Restrictions

One method that FMCs use to control commercial fishing effort or to protect specific habitats is to designate spatial or temporal fishery closures, by closing fished areas (space) or by closing fisheries temporarily, seasonally, or permanently. To notify the public of fishery or site closures, NMFS publishes the regulations, which are usually associated with an FMP amendment or FMP management action, in the *Federal Register*. When a closure has been approved, FMCs, in cooperation with NMFS, announce these closures through their websites, sending emails and faxes, or holding public meetings. In addition to closing fisheries or areas for fish conservation management reasons, regulatory agencies also use closed areas to protect marine mammals or sea turtles (e.g., from entanglement in discarded fishing gear). Permanent commercial fishing closures can prohibit various types of commercial fishing gear or fishing techniques. **Table C-80** summarizes areas where certain commercial fishing activities are prohibited or where gear restrictions apply during all or part of the year. **Figure C-100** shows the locations of most of these closure areas.

Table C-80. Seasonal and/or Area Closures to Commercial Fishing in Federal Waters in the Gulf of Mexico (Modified from: USDOI, NMFS, 2015; 50 CFR § 622.34).

Closed or Restricted Area	Location	Gear Restrictions or Protection Measures
Closures of the Gulf group king mackerel gillnet fishery	GOM EEZ	Gillnet fishery for GOM group king mackerel is closed July 1 through Martin Luther King, Jr. holiday, and subsequent weekends and holidays with exceptions.
Seasonal closure of the commercial fishery for gag, red, and black grouper	GOM EEZ	February 15 to March 15 – no possession or sale of gag, red, black grouper if only commercial permit; okay if have both charter/head boat and commercial permit and are under bag limit.
Closures of the commercial fishery for red snapper	GOM EEZ	Commercial fishery for red snapper closed from January 1 to February 1, and from the 10th of each month until the 1st on the succeeding month until quota met.
Texas closure (royal red shrimp exception)	Offshore Texas	Trawling is prohibited from May 15 to July 15 (except royal red shrimp beyond the 100-fathom depth contour).
Reef fish stressed areas	Offshore all GOM states	A powerhead may not be used to take GOM reef fish. A roller trawl or fish trap are prohibited.
West Flower Garden Banks HAPC	Offshore Texas	Fishing with bottom longline, bottom trawl, dredge, pot, or trap is prohibited.
East Flower Garden Banks HAPC	Offshore Texas	Fishing with bottom longline, bottom trawl, dredge, pot, or trap is prohibited.
Alabama SMZ	Offshore Alabama	Gulf reef fishing restrictions on catch by vessel and gear type.

GOM = Gulf of Mexico; EEZ = Economic Exclusion Zone; HAPC = Habitat Area of Particular Concern; MPA = Marine Protected Area; SMZ = Special Management Zone.

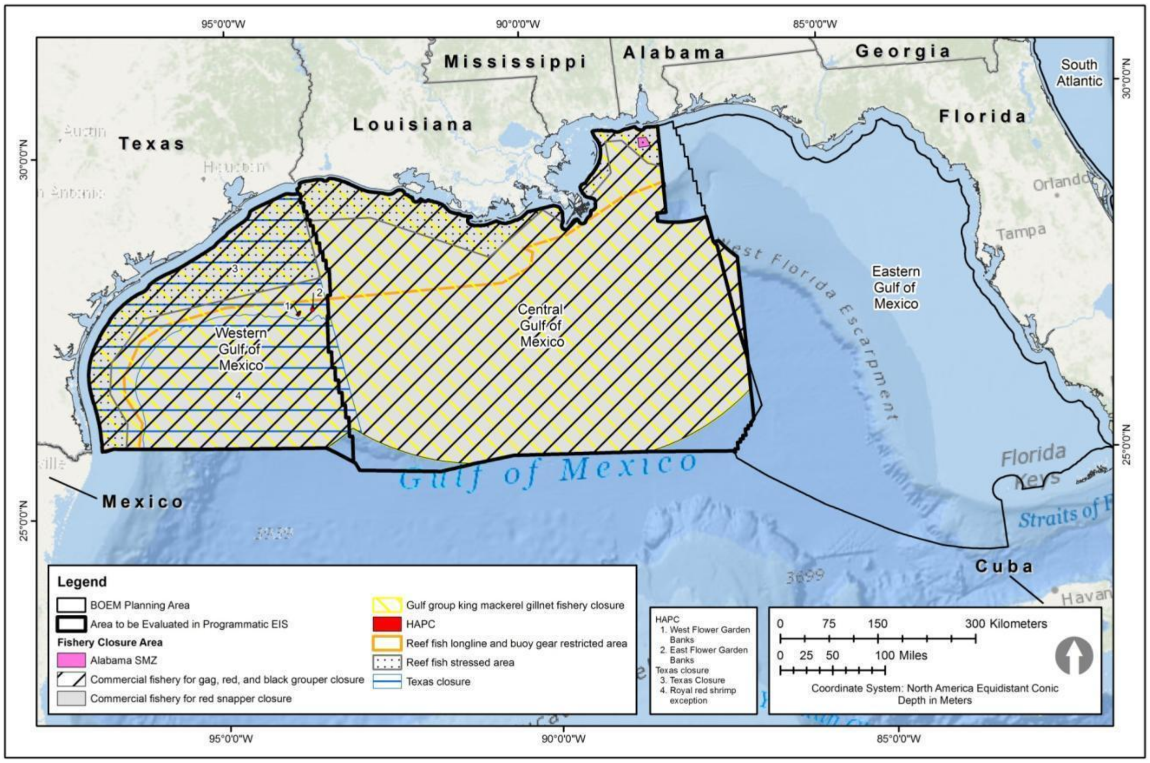


Figure C-100. Locations of Commercial Fishing Closures in Gulf of Mexico Federal Waters.

13.2.2. Recreational Fisheries

Recreational fishing is an important social and economic activity. Nationally, 8.9 million saltwater recreational anglers made 86 million trips and spent $10.3 billion in 2011 (USDOI, USFWS and U.S. Census Bureau, 2013). These expenditures included food and lodging ($2.4 billion), transportation ($1.5 billion), fishing equipment ($1.4 billion), boats ($1.3 billion), and other equipment ($217 million). In 2011, recreational fishing generated an estimated $56 billion in total output impacts, $29 billion in value-added (i.e., contribution to gross domestic product [GDP]), and $18 billion in income, and supported 364,000 U.S. jobs (Lovell et al., 2013). Saltwater recreational fisheries in states adjacent to the Gulf of Mexico Program Area are among the most valuable in the U.S. Louisiana ranked highest among the four Gulf of Mexico states adjacent to the Program Area, and third nationally (behind east and west Florida) for total expenditures and durable goods expenditures related to recreational fishing ($1.9 billion) (Lovell et al., the 2013). Overall, angler trip expenditures in Louisiana generated more sales, income, and employment impacts than the other three coastal states in the Program Area in 2011 (Lovell et al., 2013). Total angler expenditures were lowest in Mississippi ($149 million). In 2011, federal taxes generated by angler purchases ranged from $8.5 million (Mississippi) to $140 million (Louisiana), while revenue received by state and local governments ranged from $10.9 million (Mississippi) to $150 million (Louisiana) (Lovell et al., 2013).

Among the four Gulf of Mexico states adjacent to the Program Area number of trips (4.1 million), jobs generated (approximately 17,000), sales ($2.0 billion), income ($723 million), and value generated ($1.1 billion) by recreational fishing was highest in Louisiana in 2012 (**Table C-81**; USDOC, NMFS, 2014). In their comprehensive national analysis of recreational fishing, Coleman et al. (2004) estimated that saltwater fishing accounted for approximately 4 percent of the total marine fish landed in 2002. However, recreational fishing accounted for a much larger percentage of the total landings for populations of concern in the Gulf of Mexico (64 percent) (Coleman et al., 2004). Worldwide, increases in recreational fishing activity also may threaten some already overfished populations (Cooke and Cowx, 2004); in 2002, recreational fishing activities landed approximately 23 percent of the overfished stocks in the U.S. (Coleman et al., 2004).

Table C-81. Economic Impacts of Recreational Fishing Expenditures (Thousands of Dollars) in 2012 (From: USDOC, NMFS, 2014).

State	Number of Trips	Number of Jobs	Sales	Income	Value Added
Alabama	2,305,000	7,501	$691,547	$267,912	$425,328
Louisiana	4,137,000	16,972	$1,964,494	$723,662	$1,099,216
Mississippi	1,950,000	1,649	$143,890	$54,064	$85,497
Texas	N/A	13,944	$1,719,709	$615,713	$1,005,040

N/A = the Marine Recreational Program (MRIP) does not collect effort data for Texas.

13.2.2.1. Recreational Fishing Effort

The annual number of recreational angler trips is a measure of recreational fishing effort that is monitored by NMFS via the Marine Recreational Information Program (MRIP), which is an automated data query system that maintains a searchable database of recreational saltwater fishing catch, effort, and participation data and statistics. For the purposes of this Programmatic EIS, characterization of commercial fisheries is summarized primarily from the most recently published Fisheries Economics Report (USDOC, NMFS, 2014). Recreational fishing effort within the Gulf of Mexico in 2012 consisted of more than 1.9 million recreational anglers taking 8.3 million trips (**Table C-82**). In 2012, anglers were primarily residents of the coastal area (>55 percent) and fishing trips were primarily fishing from private and rental boats (55 percent), from shore (41 percent), and from charter vessels (for-hire: 4 percent). Recreational fishing is a year-round activity throughout the Program Area, and can be classified as nearshore or offshore effort, depending on the size of the vessel and its fishing location (i.e., distance from shore). Nearshore recreational fishing (<4.8 km [3.0 mi] from the coast) consists of anglers fishing from private vessels and along beaches, marshes, or manmade structures (e.g., jetties, docks, and piers), while offshore fishing consists of anglers fishing from larger, private, rental, charter, or party vessels in offshore waters (>4.8 km [3.0 mi]) (USDOC, NMFS, 2014).

Table C-82. Number of Recreational Fishing Anglers (Thousands of Anglers) and Angler Trips by Location and Mode (Thousands of Angler Trips) in Louisiana, Mississippi, and Alabama (MRIP Does Not Collect Effort Data for Texas) Between 2003 and 2012 (From: USDOC, NMFS, 2014).

	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Number of Anglers										
Area										
Coastal	1,073	1,161	1,045	1,244	1,302	1,106	999	941	1,145	1,084
Non-Coastal	255	318	190	315	327	262	295	236	311	268
Out of State	466	570	338	545	503	455	398	390	678	595
Total Anglers	**1,796**	**2,049**	**1,572**	**2,103**	**2,130**	**1,823**	**1,694**	**1,566**	**2,134**	**1,947**
Number of Angler Trips										
Vessel Type										
For-Hire	195	231	187	272	240	248	250	120	199	185
Private Boat	4,889	5,472	4,095	4,238	4,975	5,050	4,820	4,524	5,391	4,917
Shore	1,865	2,930	2,315	2,116	2,139	1,994	1,851	2,138	3,085	3,290
Total Trips	**6,949**	**8,633**	**6,597**	**6,626**	**7,354**	**7,292**	**6,921**	**6,782**	**8,675**	**8,392**

13.2.2.2. Recreational Fishing Locations

Marine fishes depend on and utilize many different types of habitats (e.g., seagrass, salt marsh, soft bottom, hard bottom) for feeding, spawning, and nursery grounds. Given the importance of these areas to the local fish fauna, recreational anglers have many options to target various species in these habitats. For example, anglers targeting reef fishes (e.g., groupers and snappers) target offshore structures, including natural and artificial reefs or ledges, while anglers pursuing inshore fishes (e.g., spotted seatrout [*Cynoscion nebulosus*] and redfish) target seagrass habitat.

13.2.2.3. Recreational Catch Characteristics

The choice of fish species targeted by recreational anglers depends on the season, fishing location, and seasonal movement of that particular species. For example, one of the best times to target pelagic species such as dolphinfish and sailfish in the Gulf of Mexico is during late summer and early fall. Bottom fishing for snapper, grunts and porgies increases during the summer months, while grouper fishing is best during winter months. Recreational fishing is a year-round activity, but many anglers target specific species at certain times, and recreational fishing effort is often weather-dependent; more recreational fishing effort occurs during spring through summer when the weather is ideal for anglers fishing from small watercraft.

The types and numbers of fishes caught by recreational anglers vary by state within the Gulf of Mexico Program Area. The key species and the number of fish caught per year between 2003 and 2012 are presented in **Table C-83**. Of the Gulf of Mexico region's key species or species groups, spotted seatrout (21.4 million fish), red drum (6.5 million fish), sand seatrout (*Cynoscion arenarius*) and silver seatrout (*C. nothus*) (5.4 million fish), and Atlantic croaker (4.9 million fish) were caught most often by anglers in 2012 (**Table C-83**).

Table C-83. Recreational Harvest (H) and Release (R) of Key Species and Species Groups (Thousands of Fish) (From: USDOC, NMFS, 2014).

Species	Harvest/ Release	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Bluefish	H	46	131	15	13	26	16	14	30	74	55
	R	126	216	77	150	175	54	46	80	166	197
Atlantic croaker	H	917	897	812	1,417	1,314	1,766	1,177	1,481	2,102	1,293
	R	2,225	3,435	2,764	2,157	2,194	2,945	3,638	3,551	5,518	3,577
Southern/Gulf kingfish	H	972	1,174	728	696	705	923	822	847	820	570
	R	309	606	515	641	367	434	404	404	403	294
Black drum	H	570	572	362	442	452	625	617	564	597	496
	R	834	1,026	651	717	729	1,116	974	1,033	1,085	882
King mackerel	H	19	15	14	29	11	8	16	6	9	16
	R	0	0	0	0	0	0	0	0	0	0
Spanish mackerel	H	123	468	45	58	91	111	76	254	335	515
	R	99	277	52	49	21	32	59	102	128	148
Sand/Silver seatrouts	H	2,478	2,007	1,670	1,802	1,984	2,804	3,422	4,247	5,097	3,634
	R	857	807	660	1,128	1,251	1,399	1,985	1,595	2,246	1,732
Spotted seatrout	H	8,878	10,429	8,902	12,656	10,589	13,499	12,776	9,755	13,244	12,122
	R	8,747	9,870	8,465	10,599	8,790	11,433	9,693	6,094	7,738	9,296
Sheepshead	H	1,257	1,856	1,031	562	654	1,057	925	740	1,666	909
	R	634	773	538	565	329	631	530	494	358	339
Red drum	H	2,577	2,892	2,047	2,304	2,724	3,103	2,668	3,276	3,603	2,508
	R	3,977	3,708	2,979	3,564	3,664	4,454	4,085	4,476	3,554	4,030
Red snapper	H	530	445	393	429	424	242	282	83	291	334
	R	921	924	884	1,120	1,146	705	644	319	596	326
Southern flounder	H	752	811	584	524	615	502	681	796	836	804
	R	251	257	189	154	136	119	192	216	220	303
Yellowfin tuna	H	14	8	10	14	8	17	3	1	13	25
	R	<1	<1	1	1	1	7	<1	<1	4	3
Striped mullet	H	550	192	34	2	66	79	119	188	491	396
	R	65	2	<1	3	14	4	4	13	83	108
Sharks*	H	8	8	9	4	4	3	21	71	35	15
	R	60	39	36	38	41	11	36	87	37	103

*Sharks include requiem shark family, blacktip sharks, Atlantic sharpnose sharks, and unidentified sharks.
No release data were available from Texas. Data collected by the TPWG not from MRIP are reported in this table.

13.2.2.4. Recreational Fishing Tournaments

Organized saltwater fishing tournaments are popular amateur and professional events that are held in the Program Area from Texas to Alabama. Recreational fishing tournaments are held year-round, but most take place on summer weekends. In general, many fishing tournaments are held at the same time and place each year; the local community often relies upon fishing tournaments to stimulate the local economy (e.g., restaurants, hotels, fuel, and supplies). Some of these tournaments are large enough to have corporate sponsors who donate prizes. Depending on the fishing tournament and its rules, participants have the option to target inshore (e.g., red drum, spotted seatrout, snook) or offshore (dolphinfish, wahoo, kingfish) categories, or to enter both categories. Every fishing tournament has its own set of rules for classes of eligible fish, size limits, time limits, and specific geographical boundaries. Based on the tournament's rules and the eligible fish, participant teams choose fishing sites and tactics according to their fishing experience and local knowledge. Throughout the Gulf of Mexico Program Area, there are many fishing tournaments that are annual events; however, it is difficult to identify every possible tournament, given that some tournaments are only one-time events and sponsorships can change from year to year. In general, saltwater fishing tournaments in the Program Area have become such a local tradition and social activity that there is at least one tournament every weekend somewhere between Texas and Alabama during the spring and summer months (**Table C-84**). Many of these fishing tournaments are held in conjunction with seafood festivals or other local festivals in the community.

Table C-84. Summary of Recreational Fishing Tournaments in the Gulf of Mexico.

Annual Tournaments Held (from 2013 to 2015)	Tournament Locations	Months Held	Species Targeted
Alabama			
Orange Beach Billfish Classic, MBGFC Ladies Tournament, MBGFC Junior Angler Tournament, Blue Marlin Grand Championship, MS Gulf Coast BGFC Ladies Tournament, Alabama Deep Sea Fishing Rodeo, Gulf Coast Outboard Classic, MBGFC Billfish Limited Tournament, and Gulf Coast White Marlin Shootout	Orange Beach; Dauphin Island	May, June, July, and August	White and blue marlin, sailfish, longbill and roundscale spearfish; swordfish; ridgeback, non-ridgeback and pelagic sharks; bluefin, bigeye, yellowfin, and skipjack tuna
Louisiana			
New Orleans BGFC (First, Invitational, Regular/General, Grand Isle/Faux Pas, Cajun Canyons, Ladies, Labor Day and Last Tournaments), Louisiana Council of Underwater Dive Clubs, Houma Oilman's Fishing Invitational, Cajun Canyons Billfish Classic, Helldivers Spearfishing Rodeo, Swollfest Fishing Rodeo, Fourchon Oilman's Association Fishing Tournament, Faux Pas Lodge Invitational	Metairie, Venice, Port Eads, Cocodrie, Kenner, Port Fourchon, Grand Isle	January, May, June, July, August, September, and December	White and blue marlin, sailfish, longbill and roundscale spearfish; swordfish; non-ridgeback, small coastal, and pelagic sharks; bluefin, bigeye, yellowfin, albacore and skipjack tuna
Mississippi			
Mississippi Gulf Coast Billfish Classic, Mississippi Deep Sea Fishing Rodeo, and Carl Legett Memorial Fishing Tournament	Biloxi, Gulfport	June, July, and August	White and blue marlin; sailfish; swordfish; non-ridgeback, small coastal, and pelagic sharks; bigeye, albacore, yellowfin, and skipjack tuna; wahoo; dolphinfish
Texas			
Texas International Fishing Tournament, South Texas BGFC Tournaments (under various names), Bastant/John UHR Memorial Billfish Tournament, Sharkathon, Texas Women Anglers Tournament, Lonestart Shootout, Texas Billfish Championship, Deep Sea Round Up, Poco Bueno	Port Isabel, South Padre Island, Port Mansfield, Rockport, Corpus Christi, Port Aransas, Port O'Connor, Surfside, Freeport	May, June, July, August, September, October	White and blue marlin; sailfish; longbill and roundscale spearfish, swordfish; ridgeback, non-ridgeback, small coastal, and pelagic sharks; bluefin, yellowfin, and skipjack tuna; wahoo, dolphinfish

13.3. ATLANTIC PROGRAM AREA

13.3.1 Commercial Fisheries

The states within the Atlantic Program Area that are covered under this Programmatic EIS include Virginia, North Carolina, South Carolina, and Georgia (Figure 2.1-3 in the Programmatic EIS). This characterization of commercial fisheries in the Atlantic states is primarily summarized from the most recently published Fisheries Economics Report (USDOC, NMFS, 2014).

In 2012, the seafood industry in the four pertinent states adjacent to the Atlantic Program Area supported nearly 44,000 jobs (**Table C-85**). Commercial fisheries are an important component of the economy of these Atlantic states. In 2012, the Atlantic region's seafood industry generated a total of $4.4 billion in sales, with Georgia and Virginia generating $2.0 billion and $1.5 billion of that total, respectively. Virginia generated the largest income ($462 million), number of jobs (approximately 19,000), and landings revenue ($176 million). Georgia generated the highest value added impacts ($717 million).

Table C-85. Economic Impacts of the Atlantic Region Seafood Industry (Thousands of Dollars) in 2012 (From: USDOC, NMFS, 2014).

State	Revenue	Number of Jobs	Sales	Income	Valued Added
Virginia	$175,640	19,052	$1,538,449	$461,762	$673,068
North Carolina	$72,912	8,800	$782,684	$218,377	$325,893
South Carolina	$23,978	1,766	$119,975	$41,253	$57,683
Georgia	$16,315	14,124	$1,962,985	$435,997	$717,018
Total	**$288,845**	**43,742**	**$4,404,093**	**$1,157,389**	**$1,773,662**

13.3.1.1. Commercial Landings

Table C-86 shows commercial landings in thousands of pounds of key species or species groups within the four Atlantic states, including Atlantic croaker, black sea bass, blue crab, goosefish, menhaden, sea scallops, spot, striped bass (*Morone saxatillis*), flounders, clams, groupers, shrimp, snappers and tunas (USDOC, NMFS, 2014). Fishers in these four states landed 541 million pounds of finfish and shellfish in 2012. This was a 12.6 percent decrease from the 609 million pounds landed in 2003 and an 8.4 percent decrease from the 586 million pounds landed in 2011. Total landings in these states contributed 63 percent of the total landings in the Mid-Atlantic and South Atlantic Planning Areas (859 million pounds) in 2012.

Commercial fisheries in the Atlantic Program Area target a variety of fish and invertebrate species in both state and federal waters. Landings data do not indicate actual areas where particular species were caught, so inferences must be made using knowledge of broad habitat use by species represented in the data set. For example, landings data indicate that blue crab is an important fishery species in Virginia and North Carolina, but blue crabs live primarily in inshore waters and would not be part of the fisheries for the Program Area. The eastern oyster provides a similar example of an inshore species making significant contribution to landings data from Virginia that should not be used to characterize fisheries in the Atlantic Program Area.

Table C-86. Total Landings and Landings of Key Species/Species Groups (Thousands of Pounds) (From: USDOC, NMFS, 2014).

Key Species/ Species Group	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Atlantic croaker	25,365	21,481	21,175	18,226	17,859	17,006	14,711	15,185	10,589	9,994
Black sea bass	1,462	1,591	1,280	1,192	776	832	947	763	647	766
Blue crab	70,358	69,108	60,236	56,357	55,124	64,899	70,074	74,777	76,763	68,817
Goosefish	1,270	1,002	1,157	677	847	972	743	596	604	907
Menhaden	373,868	399,798	372,578	370,946	420,481	353,895	351,392	433,241	413,835	390,284
Sea scallop	17,536	19,410	11,444	8,302	9,916	9,685	10,137	9,167	8,260	5,798
Spot	3,471	4,338	3,103	1,696	4,328	1,977	3,910	1,024	3,540	596
Striped bass	2,104	2,120	2,472	1,431	1,962	2,196	2,109	2,139	2,077	2,173
Flounders	9,294	11,208	9,806	9,029	6,610	6,663	7,236	7,593	8,153	6,857
Clams	885	832	705	638	622	573	566	599	546	604
Groupers	884	841	800	986	1,142	1,062	827	734	635	468
Shrimp	17,891	14,744	10,846	13,238	15,061	15,721	11,445	14,454	12,413	13,463
Snappers	559	831	880	612	893	880	568	685	682	705
Tunas	914	1,424	1,271	1,982	1,836	1,041	1,028	703	1,056	1,482
Finfish Total	**498,087**	**526,594**	**454,696**	**431,944**	**485,080**	**414,717**	**414,182**	**492,869**	**474,993**	**442,011**
Shellfish Total	**111,308**	**110,956**	**87,299**	**81,925**	**88,424**	**98,597**	**98,311**	**107,380**	**111,470**	**99,169**
Total Landings	**609,394**	**637,550**	**541,995**	**513,869**	**573,504**	**513,313**	**512,492**	**600,250**	**586,463**	**541,181**

13.3.1.2. Commercial Fishing Gears

The main types of commercial fishing gear used along the Atlantic Coast are pots/traps, dredges, trawls, bottom and pelagic longlines, gillnets, purse seines, and pound nets. Most of these are described in **Section 13.2.1.2**. With respect to commercial fishing gear used in the Atlantic Program Area:

- Pot or traps are rectangular, square, or cylindrical enclosed devices with one or more gates or entrances set on the bottom to target benthic fishes and invertebrates such as lobsters, conch (Strombidae), black sea bass, and deepsea red crabs.
- Dredges are a steel frame box or bag-shaped device used to target benthic sessile species such as bivalve mollusks (clams, oysters, scallops, and mussels). Dredges are towed behind a fishing vessel along the bottom at approximately 2.5 kn; the vessel slows down as the dredge collects clams. The typical dredge is 3.7-m (12-ft) wide and approximately 6.7-m (22-ft) long and uses pressurized water jets to wash clams out of the bottom. The water jets penetrate the sediment in front of the dredge to a depth of approximately 20 to 25 cm (8 to 10 in.), which dislodges the clams. On the leading bottom edge of the dredge there is a “cutting bar” opening that guides the clams into the body of the dredge, which is sometimes referred to as “the cage” (Stevenson et al., 2004).
- Bottom trawls are designed to be towed along the seafloor to catch a variety of demersal fish and invertebrate species, e.g., shrimps, Atlantic mackerel, summer flounder (Paralichthys dentatus), black sea bass, scup, Atlantic croaker, and winter

flounder (Pseudopleuronectes americanus). Mid-water trawls are designed to catch pelagic species in the water column such as squids (Chuenpagdee et al., 2003).

- Longlines are used to target benthic species (e.g., tilefish and large coastal sharks), coastal pelagic species (e.g., dolphin and wahoo), or pelagic species (e.g., tunas, swordfish, or pelagic sharks) (Chuenpagdee et al., 2003; Stevenson et al., 2004).
- Drift gillnets are used to target Atlantic bonito (Sarda sarda), weakfish (Cynoscion regalis), and bluefish, while stake gillnets are used to target Atlantic menhaden, Atlantic croaker, butterfish, spot, northern kingfish (Menticirrhus saxatilis), bluefish, weakfish, and smooth dogfish (Mustelus canis) (Chuenpagdee et al., 2003; Stevenson et al., 2004).
- Purse seines are used to target Atlantic menhaden and Atlantic herring, and also sometimes bluefish in nearshore waters (Chuenpagdee et al., 2003).
- Pound nets are a fixed entrapment gear constructed of netting that is attached to piles or stakes driven into the seafloor. Pound nets consist of three sections: a leader (net body or crib with a netting floor and open top), at least one heart leading into the crib, and the pound. The leader or leaders can be as long as 400 m (1,300 ft); the leader is used to direct fish into the heart(s) of the net. The heart section then funnels fish into the pound section to prevent escape. The pound holds fish until the net is emptied. In general, these nets are used in shallow waters <6.1 m (20 ft) deep. Pound nets are used to catch a wide variety of inshore finfishes such as striped bass, bluefish, catfish, croaker, flounder, menhaden, perch, spot, weakfish, and river herring (Chuenpagdee et al., 2003; Stevenson et al., 2004).

13.3.1.3. Commercial Fishing Locations and Seasons

Commercial landings can show seasonal patterns in fish abundance or the effects of legislative closures but do not provide actual locations of fishing activity. Such information must be inferred from species-specific habitat preferences and the particular gear used. **Table C-87** summarizes this information for key species or species groups targeted in the Atlantic.

Table C-87. Primary Commercial Fishing Methods, Species Sought, Seasons, and General Atlantic Areas Fished.

Fishing Method	Species Sought	Primary Fishing Season	Primary Fishing Area
Bottom trawling (including skimmer nets)	Brown shrimp, pink shrimp, white shrimp, rock shrimp, royal red shrimp, and groundfish	Year-round depending on species and seasonal closures	Soft bottom, shelf waters from nearshore to the upper slope off northern Florida, Georgia, South Carolina, North Carolina, and Virginia outside of closed areas
Purse netting	Menhaden	Spring and summer months	Virginia
Gillnetting	Coastal sharks, mullets, king mackerel, and Spanish mackerel	Spring and summer depending on species and seasonal closures	Shelf waters outside of closed areas
Hook-and-lining (bottom fishing and trolling)	Snappers, groupers, amberjacks, wreckfish, triggerfishes, sharks, king mackerel, Spanish mackerel, cobia, dolphinfishes, and wahoo	Year-round; effort varies with species-specific closures	Artificial reefs and natural hard bottom areas throughout the region, with most activity on inner and middle shelf.
Surface longlining	Sharks, swordfish, tunas, and dolphinfish	Year-round with summer peaks	Depths >200 m (656 ft) outside of closed areas

Bottom longlining	Groupers, snappers, tilefishes, and sharks	Year-round; effort varies with species-specific closures	Outer shelf waters from Florida to Virginia on suitable bottom type outside of closed areas
Trapping	Golden crabs and spiny lobsters	Golden crabs (year-round); spiny lobster (July to March)	Upper slope (golden crab); middle and outer shelf (spiny lobster)

13.3.1.4. Time and Area Closures and Gear Restrictions

Table C-88 summarizes areas where certain commercial fishing activities are prohibited or where gear restrictions apply during all or part of the year. **Figure C-101** shows the locations of most of these closure areas. Areas where the Atlantic Large Whale Take Reduction Plan (USDOC, NMFS, 2010e) mandates trap/pot and gillnet restrictions are shown in **Figure C-102** and **C-103**, respectively.

Table C-88. Seasonal and Area Closures to Commercial Fishing in Federal Waters Offshore the Mid-Atlantic and South Atlantic States (Modified from: USDOC, NMFS, 2010d; 50 CFR § 622.35).

Closed or Restricted Area	Location	Season	Gear Restrictions or Protection Measures	Reason/Purpose
Deepwater MPAs: Snowy Grouper Wreck; Northern South Carolina; Edisto; Charleston Deep Artificial Reef; Georgia; and North Florida	Cape Fear, NC to Jacksonville, FL (two others offshore south FL are outside the Area of Interest)	Year-round	No bottom longline gear	Protect snapper-grouper complex species
Proposed deepwater *Lophelia* coral HAPCs: Cape Lookout, Cape Fear, Blake Ridge Diapir, and Stetson-Miami Terrace	South Atlantic Bight	Year-round	No anchors or chains; bottom longline, trawl (mid-water and bottom), dredge, pot, and trap gear prohibited	Protect deepwater corals
SMZs (51 sites)	Offshore SC, GA, and FL	Year-round	Restrictions vary; examples include prohibitions on powerhead, bottom longline, fish traps or pots, and hydraulic or electric reels	Protect snapper-grouper complex species
Allowable octocoral closed area	Atlantic EEZ north of 28°35.1’ N	Year-round	No harvest or possession of octocoral	Protect deepwater corals
Pelagic *Sargassum* area	All EEZ waters south of 34° N and waters within 100 nmi (185 km) of the coast from 34° N to the NC/SC border	July 1 to October 31	All *Sargassum* harvest prohibited in the closed area; elsewhere prohibited July to October, with catch limits and restrictions on mesh and frame size of nets	Protect *Sargassum* as habitat for sea turtles and essential fish habitat for snappers, groupers, and coastal migratory pelagic fishes

Table C-88. Seasonal and Area Closures to Commercial Fishing in Federal Waters Offshore the Mid-Atlantic and South Atlantic States (Modified from: USDOC, NOAA, NMFS, 2010d; 50 CFR § 622.35) (Continued).

Closed or Restricted Area	Location	Season	Gear Restrictions or Protection Measures	Reason/Purpose
Longline closed areas	All waters south of 27°10’ N, and waters north of 27°10’ N where depth is <91 m (300 ft)	Year-round	No longline gear for snapper-grouper	Protect snapper-grouper complex species
Charleston Bump Area	Offshore NC and SC and Jekyll Island, GA	February 1 to April 30	No pelagic or bottom longline gear	Protect juvenile swordfish and reduce bycatch
Cape Hatteras Special Research Area	35° N, 75° W, 6°25’ N, 74°35’ W	Year-round	Pelagic longline gear must be <20 nmi (37 km)	Pelagic longline take reduction of Risso’s dolphin and short-finned pilot whales
East Florida Coast Area	Offshore Jekyll Island, GA; FL east coast; Key West, FL	Year-round	No pelagic or bottom longline gear	Protect juvenile swordfish and billfishes
Mid-Atlantic Shark Area	Offshore Oregon Inlet, NC and Cape Fear, NC	January 1 to July 31	No bottom longline and shark gillnet gear	Protect juvenile sharks and prohibited sharks
Carl N. Schuster, Jr. Horseshoe Crab Reserve	Offshore DE, MD, and VA	Year-round	No trawl nets, pound nets, gillnets, or fyke nets	Protect horseshoe crab spawning population and maintain crab eggs for migratory shorebirds
South Atlantic shrimp cold weather closure	Offshore NC, SC, GA, and FL	In winter during severe cold weather, when adjacent South Atlantic states close all or part of their waters to shrimp trawling	No trawling for brown, pink, or white shrimps	Protect shrimp populations depleted by severe cold weather
Golden crab trap closed areas	Southeastern U.S. (divided into Northern, Middle, and Southern zones)	Year-round	Vessel size restrictions; permits limit a vessel to a particular zone	Protect golden crab from overfishing
Atlantic Large Whale Take Reduction Plan	Entire U.S. Atlantic coast (divided into several subareas)	September 1 to May 31 from 32° N to northern edge of Area of Interest; November 15 to April 15 from 29° to 32° N; December 1 to March 31 from 29° N to southern edge of Area of Interest	Restrictions on trap/pot and gillnet use	Protect large whales from entanglement

EEZ = Economic Exclusion Zone; HAPC = Habitat Area of Particular Concern; MPA = Marine Protected Area; SMZ = Special Management Zone.

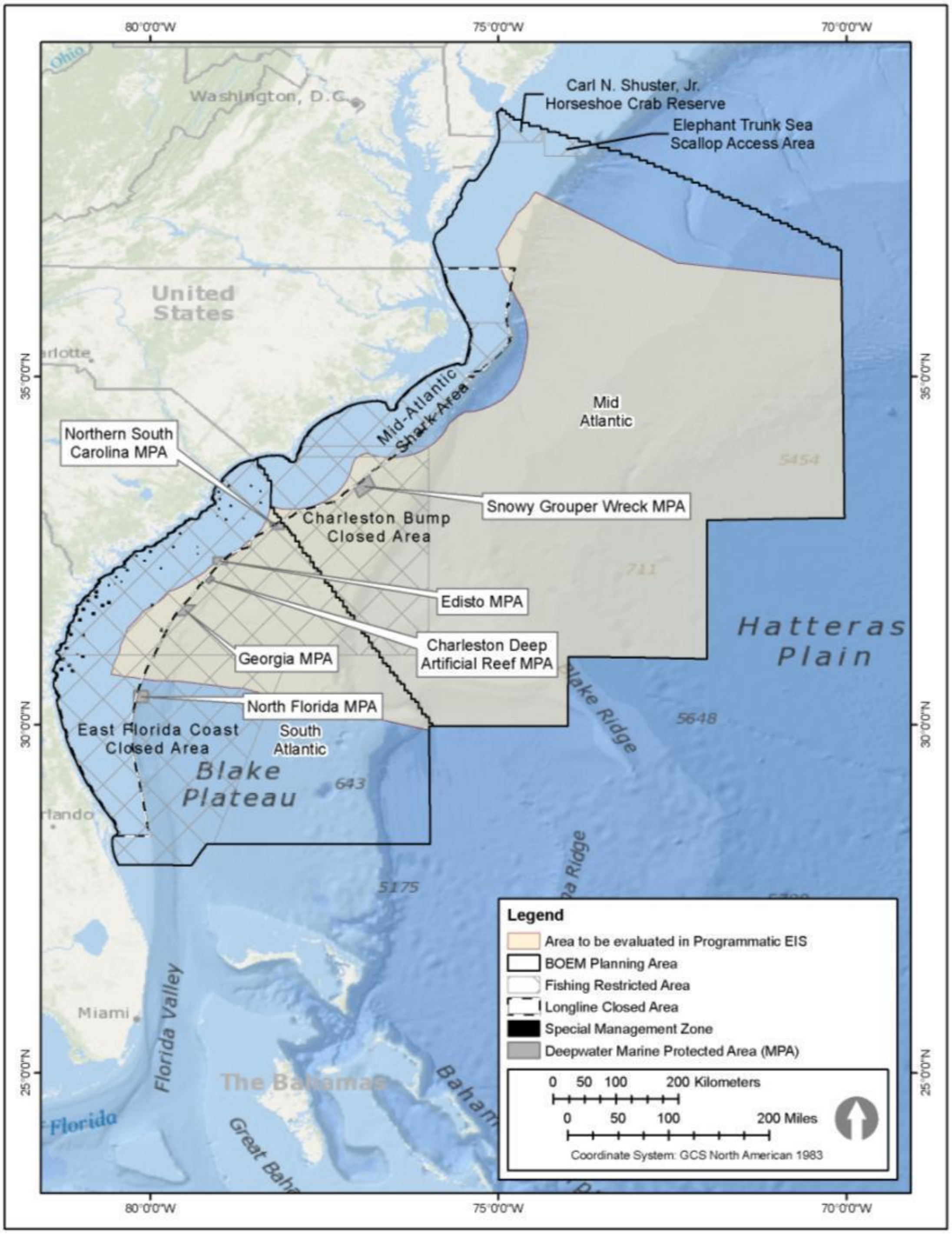


Figure C-101. Locations of Selected Seasonal and/or Area Closures to Commercial Fishing in Federal Waters Offshore States Adjacent to the Mid-Atlantic and South Atlantic Planning Areas (Additional Restrictions Apply in HAPCs).

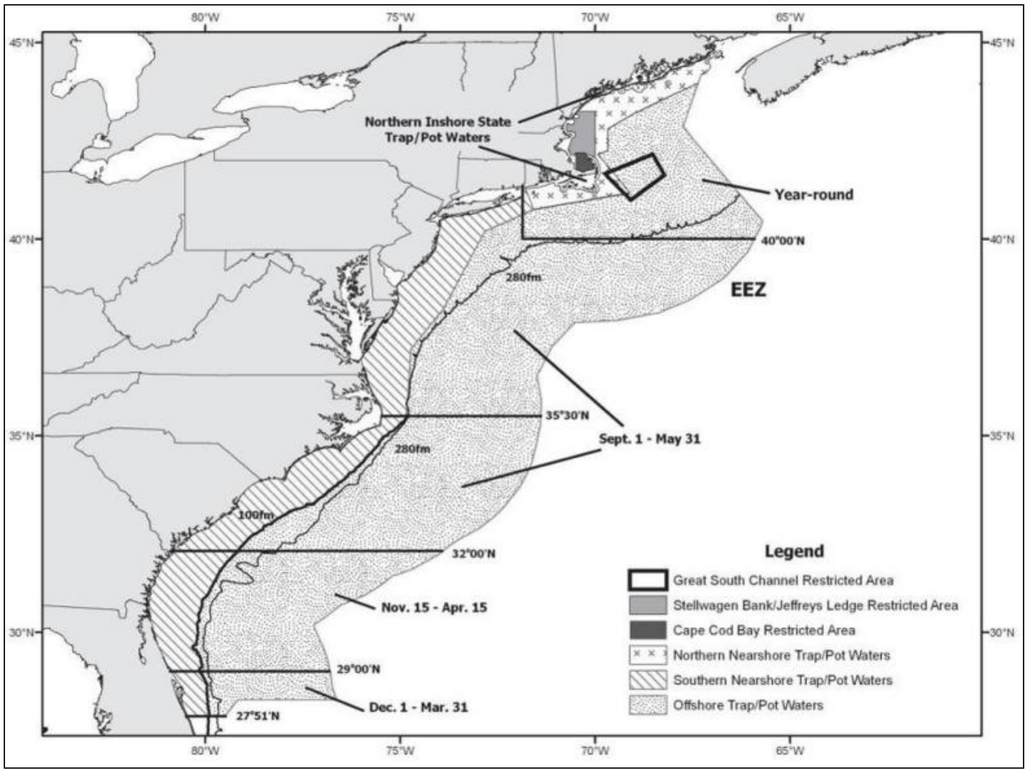


Figure C-102. Regulated Trap/Pot Areas under the Atlantic Large Whale Take Reduction Plan (From: USDOC, NMFS, 2010e).

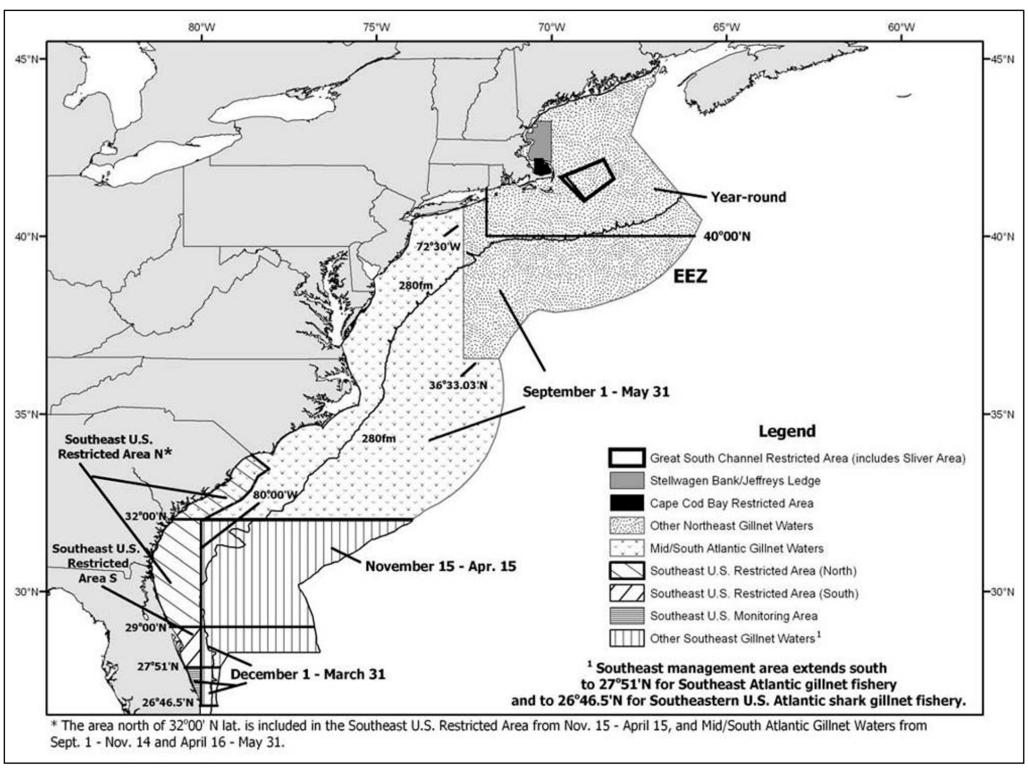


Figure C-103. Regulated Gillnet Areas under the Atlantic Large Whale Take Reduction Plan (From: USDOC, NMFS, 2010e).

13.3.2. Recreational Fisheries

Recreational fishing is an important social and economic activity. Saltwater recreational fisheries in states adjacent to the Atlantic Program Area are among the most valuable in the U.S. Louisiana ranked highest among the four Atlantic states adjacent to the Program Area (Figure 2.1-2 in the Programmatic EIS), and fourth nationally (behind east and west Florida and Louisiana) for total expenditures and durable goods expenditures related to recreational fishing ($1.6 billion) (Lovell et al., 2013). Overall, angler trip expenditures in North Carolina generated more sales, income, and employment impacts than in the other three Atlantic states adjacent to the Program Area in 2011 (Lovell et al., 2013). Total angler expenditures were lowest in South Carolina ($287 million). In 2011, federal taxes generated by angler purchases ranged from $26 million (Georgia) to $181 million (Virginia), though zero federal taxes were generated in South Carolina. Revenue received by state/local governments ranged from $26 million (Georgia and South Carolina) to $133 million (North Carolina) (Lovell et al., 2013).

Among the four Atlantic states adjacent to the Program Area number of trips (5.3 million), jobs generated (approximately 18,000), sales ($1.9 billion), income ($691 million), and value generated ($1.1 billion) by recreational fishing was highest in North Carolina in 2012 (**Table C-89**; USDOC, NMFS, 2014).

Table C-89. Economic Impacts of Recreational Fishing Expenditures (Thousands of Dollars) in 2012 (From: USDOC, NMFS, 2014).

State	Number of Trips	Number of Jobs	Sales	Income	Value Added
Virginia	2,522,000	8,143	$834,499	$333,092	$539,985
North Carolina	5,304,000	18,202	$1,867,621	$691,732	$1,113,168
South Carolina	2,206,000	4,095	$383,622	$141,006	$228,682
Georgia	892,000	2,787	$298,791	$117,042	$187,681
Total	10,924,000	33,227	$10,957,227	$1,282,872	$1,881,835

13.3.2.1. Recreational Fishing Effort

Recreational fishing effort within the Atlantic states in 2012 consisted of more than 3.4 million recreational anglers taking 11 million trips (**Table C-90**). In 2012, 40 percent of the anglers were primarily residents of the coastal area, and fishing trips were run by private/rental boats (47 percent), shore (51 percent), and charter vessels (for-hire: 2 percent). Recreational fishing is a year-round activity throughout the Atlantic Program Area, and can be classified as nearshore or offshore effort, depending on the size of the vessel and its fishing location (distance from shore). Nearshore recreational fishing (<4.8 km [3.0 mi]) consists of anglers fishing from private vessels and along beaches, marshes, or manmade structures (e.g., jetties, docks, and piers), while offshore fishing consists of anglers fishing from larger vessels (private, rental, charter, or party) in offshore waters (>4.8 km [3.0 mi]) (USDOC, NMFS, 2014).

Table C-90. Number of Recreational Fishing Anglers (Thousands of Anglers) and Angler Trips by Location and Mode (Thousands of Angler Trips) in Virginia, North Carolina, South Carolina, and Georgia Between 2003 and 2012 (From: USDOC, NMFS, 2014).

	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Number of Anglers										
Coastal	1,242	1,454	1,609	1,521	1,453	1,477	1,338	1,395	1,300	1,367
Non-Coastal	525	580	609	567	569	649	549	599	507	580
Out of State	1,898	1,971	2,282	2,388	1,972	2,119	1,880	1,907	1417	1,437
Total Anglers	3,666	4,005	4,499	4,476	3,993	4,244	3,768	3,903	3,224	3,384
Number of Angler Trips										
For-Hire	311	356	346	327	394	335	290	294	279	250
Private Boat	5,819	6,848	6,396	6,500	6,749	6,811	5,653	5,507	5,148	5,172
Shore	6,785	6,789	6,893	6,862	5,762	6,907	5,670	5, 643	4,990	5,502
Total Trips	12,915	13,993	13,635	13,689	12,905	14,053	11,613	11,444	10,417	10,924

13.3.2.2. Recreational Fishing Locations

Marine fishes depend on and utilize many different types of habitats (e.g., seagrass, salt marsh, soft bottom, hard bottom) for feeding, spawning, and nursery grounds. Given the importance of these areas to the local fish fauna, recreational anglers have many options to target various species in these habitats. For example, anglers targeting reef fishes (groupers and snappers) target offshore structure (natural and artificial reefs or ledges), while anglers pursuing inshore fishes (spotted seatrout and redfish) target seagrass habitat.

13.3.2.3. Recreational Catch Characteristics

The choice of fish species targeted by recreational anglers depends on the season, fishing location, and seasonal movement of that particular species. For example, one of the best times to target HMS such as marlin and sailfish off the coast of Florida is during winter. Other species such as grouper and snappers are found off North Carolina and South Carolina year-round, but reef fishes do migrate to deeper offshore waters during winter. Recreational fishing is a year-round activity, but many anglers target specific species at certain times, and recreational fishing effort is often weather-dependent; more recreational fishing effort occurs during spring through summer when the weather is ideal for anglers fishing from small watercraft.

The types and numbers of fishes caught by recreational anglers vary by state within the Atlantic Program Area. The key species landed by recreational anglers in the Atlantic states (Virginia, North Carolina, South Carolina, and Georgia) between 2003 and 2012 are shown in **Table C-91**. Of the Atlantic state's key species or species groups, Atlantic croaker and spot (15.7 million fish), spotted seatrout (5.3 million fish), black sea bass (4.1 million fish), and red drum (3.3 million fish) were caught most often by anglers in 2012 (**Table C-91**).

TableC-91. Recreational Harvest (H) and Release (R) of Key Species and Species Groups (Thousands of Fish) (USDOC, NMFS, 2014).

Species	Harvest/ Release	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Flounder[1]	H	756	1131	963	1047	757	483	511	548	539	475
	R	3,483	5,160	3,468	3,306	4,218	4,218	4,910	4,008	3,006	2,293
Black sea bass	H	579	752	425	457	306	286	277	398	214	186
	R	2,686	3,460	3,042	3,299	3,436	3,256	2,402	2,431	2,394	3,915
Spanish mackerel	H	374	382	406	329	590	798	752	555	455	571
	R	388	235	365	124	356	517	368	322	238	333
Sharks[1]	H	4	16	40	*1	5	8	14	*1	6	4
	R	592	695	970	870	752	777	727	735	644	948
Atlantic croaker and spot	H	13,396	15,256	14,320	15,605	19,374	17,787	9,811	8,132	8,717	6,946
	R	11,800	10,755	14,716	12,109	14,071	12,724	13,488	9,066	10,642	8,786
Red drum	H	300	252	239	130	231	274	177	379	267	196
	R	746	613	856	863	773	1,104	1,097	1,299	939	3,136
Dolphinfish	H	335	268	663	522	533	358	367	499	472	327
	R	14	5	2	24	5	2	3	5	8	2
Weakfish	H	86	158	44	43	88	28	16	4	4	22
	R	504	545	355	556	230	427	84	178	289	103
Spotted seatrout	H	758	884	1,122	1,217	1,427	1,555	1,260	697	820	1390
	R	1,391	1,406	2,355	2,031	2,823	2,703	2,699	3,384	3,963	3,922
Bluefish	H	1,020	1,362	1,633	1,054	1,445	1,314	964	1,561	1,380	1,101
	R	1,654	2,164	2,382	2,481	3,157	2,586	1,877	2,646	2,543	1,257
Southern kingfish	H	1,487	1,810	1,509	1,374	1,274	1,520	1,643	974	1,482	1,155
	R	1,896	1,568	954	1,831	1,165	1,485	1,249	464	736	751
Striped bass	H	540	825	395	560	287	281	238	108	229	78
	R	1,255	2,318	1,419	1,718	1,031	707	480	243	450	278

[1] Flounder mix of left eye, summer, southern flounder species.
[2] Sharks include requiem shark family, blacktip sharks, Atlantic sharpnose sharks, and unidentified sharks.

13.3.2.4. Recreational Fishing Tournaments

Organized saltwater fishing tournaments are popular amateur and professional events that are held throughout the Atlantic Program Area from Virginia to Georgia. Recreational fishing tournaments are held year-round, but most take place in summer during weekends. In general, many fishing tournaments are held at the same time and place each year; the local community often relies upon fishing tournaments to stimulate the local economy (e.g., restaurants, hotels, fuel, and supplies). Some of these tournaments are large enough to have corporate sponsors who donate prizes. Depending on the fishing tournament and its rules, participants have the option to target inshore (e.g., red drum, spotted seatrout, snook) or offshore (dolphin, wahoo, kingfish) categories, or enter both categories. Every fishing tournament has its own set of rules for classes of eligible fish, size limits, time limits, and specific geographical boundaries. Based on the tournament's rules and eligible fish, participant teams choose fishing sites and tactics according to their fishing experience and local knowledge. Throughout the Program Area, there are many fishing tournaments that are annual events; however, it is difficult to identify every possible tournament given that some tournaments are only one-time events and sponsorships can change from year to year. The current list of tournaments between Virginia and Georgia is shown in **Table C-92**. Many of these fishing tournaments are held in conjunction with seafood festivals and other local festivals within the community.

Table C-92. Partial List of Recreational Fishing Tournaments within the Area of Interest (From: Caught the Skunk.com, 2011; Florida Sportsman, 2011; World Fishing Network, 2011).

State	Fishing Tournament	Tournament Dates
Virginia	• Virginia Saltwater Fishing Tournament • Virginia Beach Rockfish Frostbite Challenge • Triple Threat Tournament • Croaker Fishing Tournament • Virginia Beach Tuna Tournament • The Annual Colonial Beach Rockfish Tournament	• 1 January to 31 December • 15 to 18 January • 14 April to 30 August • 4 June • 11 to 14 July • 31 October to 2 November
North Carolina	• Annual Hatteras Village Offshore Open • Guiseppe Giaimo Scholarship Tournament • Big Rock Blue Marlin • Cape Fear Blue Marlin Fishing Tournament • Bay Creek Classic • U.S. Open King Mackerel Tournament • The Wahoo Challenge • Davis Island Fishing Foundation Surf Fishing Tournament • Manteo Rotary Rockfish Rodeo	• 12 to 15 May • 17 May • 10 to 18 June • 1 to 4 July • September 26 • 30 September to 2 October • 13 to 16 October • 14 to 16 October • 3 to 4 December
South Carolina	• Charleston Trident Fishing Tournament • Bohicket Marina Invitational Billfish Tournament • Annual Spring King Mackerel Tournament • Carolina Billfish Classic • Annual Fall King Mackerel Tournament • Charleston Trident Fishing Tournament	• 1 January • 11 to 14 May • 11 to 12 June • 22 to 25 May • 16 to 18 September • 1 December
Georgia	• Annual King Mackerel Tournament • Blue Water Tournament • Kingfish/General Tournament • General Tournament • General Tournament	• 13 to 16 May • 17 to 20 June • 7 August • 18 September • 16 October

14.0 TOURISM AND RECREATION

14.1. ALASKA PROGRAM AREAS

14.1.1. Beaufort Sea and Chukchi Sea Planning Areas

14.1.1.1. Recreational Resources

Non-resident recreational activity in the Arctic Region includes hunting, hiking, kayaking, and rafting in the numerous parks, preserves, and refuges adjacent to the Beaufort and Chukchi Seas. The Gates of the Arctic National Park and Preserve and the Arctic NWR are accessible from communities within the NSB and the Northwest Arctic Borough. With sea ice extent retreating, cruise ships are venturing farther north; the first cruise through the Northwest Passage in Canada is anticipated in the summer of 2016. The anticipated cruising route through the Beaufort Sea and Chukchi Sea Planning Areas is shown in Figure 4.3.15-1 in the Programmatic EIS.

Tourism opportunities in the NSB primarily operate out of Barrow or Deadhorse. Travel to these areas is primarily by air, although personal vehicles and occasional bus tours arrive in Deadhorse via the Dalton Highway that runs between Deadhorse and Fairbanks. Barrow offers cultural and educational opportunities at the Iñupiat Heritage Center, which houses native artifacts and promotes local arts and crafts.

Visitors to Northwest Arctic Borough enter or exit from Kotzebue, the largest community in the borough, primarily by air. Half of the land in the Northwest Arctic Borough is federally owned and protected, and this is a principal tourism draw. The Bering Land Bridge National Preserve is located in the Northwest Arctic Borough, and it is well known for its archaeological sites and geological features (Nuttall, 2012). Area hot springs also are becoming a popular destination for tourists (NPS, 2015).

More than 1,852 km (1,000 nmi) south of the most southerly extent of the Chukchi Sea Program Area is Unalaska and Dutch Harbor. Vessel traffic associated with offshore petroleum activities in the Beaufort Sea and Chukchi Sea Program Areas will need to pass near Dutch Harbor and utilize its infrastructure on their transit north. Unalaska and Dutch Harbor are considered a single community, with Dutch Harbor containing the port and associated industries, while the resident population is concentrated in Unalaska.

Unalaska is rich in native culture, history, and recreational opportunities for outdoor and wildlife enthusiasts. The Museum of the Aleutians is a cultural center for the Aleutian Island and Unalaska communities, offering exhibits in Aleut, Russian, American, and World War II history as well as artwork collections. There are three National Historic Landmarks in Unalaska and Dutch Harbor, and visitors may drive or hike through the World War II National Historic Area or visit the Aleutian World War II Visitor Center. Private cruise ships frequently stop in Dutch Harbor, and the Alaska Marine Highway ferry arrives once a month between April and October. In spite of the numerous opportunities for recreation and tourism, there is only one place for lodging (Port of Dutch Harbor, 2015).

14.1.1.2. Recreation and Tourism Employment

Recreation and tourism are not major sources of employment in NSB and Northwest Arctic Borough (**Table C-93**). Employment opportunities fluctuate seasonally, providing an estimated 767 to 1,039 jobs during the peak tourism season. From October 2013 through September 2014, tourism or visitor spending within the Arctic regions accounted for $25 million. The GDP in 2012 for the tourism and recreation industry in the NSB accounted for approximately $3 million. The GDP for tourism and recreation industries within the Northwest Arctic Borough for 2012 were not disclosed (Middlebury Institute of International Studies at Monterey, 2015).

Activities such as sport fishing and hunting are anticipated to expand. Examples of potential future recreation and tourism activities and employment areas are detailed in **Table C-94**.

Table C-93. Number of People Employed in Recreation and Tourism, Arctic Region (From: U.S. Census Bureau, 2013).

Sector	North Slope Borough	Northwest Arctic Borough	Arctic Region Total
Sporting goods stores	N/A	N/A	N/A
Scenic tours	N/A	N/A	N/A
Automotive rental	N/A	N/A	N/A
Museums and historic sites	N/A	N/A	N/A
Amusement and recreation	20 - 99[a]	20 - 99[a]	40 - 198[b]
Hotels and lodging places	33	0 - 19[c]	33 - 49[b]
RV parks and campsites	N/A	0 - 19[c]	0 - 19[c]
Eating and drinking places	674	20 - 99[a]	694 - 773[b]
Total	**727 - 806[b]**	**40 - 236[b]**	**767 - 1,039[b]**

N/A = No data available.
[a] Estimate of 20 to 99 employees.
[b] Total range using low and high employee estimates.
[c] Estimate of 0 to 19 employees.

Table C-94. Past, Present, and Reasonable Foreseeable Future Recreation and Tourism (From: USDOI, BOEM, 2015).

Activity Type	Area	Action/Project	Time of Year		Occurrence Period		
			Open Water	Winter	Past	Present	Future
Recreation/ Tourism (wildlife watching, sightseeing, cruise ships)	Eastern Beaufort Sea Coastal and Inland – Arctic National Wildlife Refuge	River trips, wildlife viewing, hiking, flightseeing	X		X	X	X
	Eastern Beaufort Sea Coastal and Inland – North Slope (Kaktovik)	Wildlife viewing	X		X	X	X
	Beaufort Sea Offshore and Nearshore	Cruise ships, eco tours	X			X	X
Recreational/ Sport Hunting/ Fishing	Chukchi Sea Offshore	None					
	Eastern Beaufort Sea Coastal and Inland – Arctic National Wildlife Refuge	Hunting,fishing, flightseeing	X	X	X	X	X

14.1.2. Cook Inlet Planning Area

14.1.2.1. Recreational Resources

There are abundant recreational opportunities in and around Cook Inlet, including hunting, fishing, hiking, cruising, boating, wildlife viewing, and sightseeing. Tour ships based out of the contiguous U.S. and Canada regularly traverse southeast Alaska as well as transit within Cook Inlet. The Alaska Marine Highway ferry system is used by numerous independent travelers to access the region. Marine vessels used for tourism include cruise ships, ferries, and tour boats (Figure 4.3.15-2 in the Programmatic EIS). The Cook Inlet has substantially less cruise ship activity than southeast Alaska and Prince William Sound; however, cruise ships do dock at the Port of Anchorage weekly during tourist season, which generally runs from May through September. Anchorage and the Port of Anchorage are located to the north and outside of the Cook Inlet Program Area. However, vessel traffic with an Anchorage or Port of Anchorage destination must transit through the Program Area. The Port of Anchorage is currently expanding, in part to accommodate increased cruise ship interest (Port of Anchorage, 2015). Growth of between 6 and 18 cruise ship visits annually for the next 10 years is projected (Port of Anchorge, 2015).

The tourism sector is generally robust, especially during the months when fishing and hunting seasons are open. The timing of fishing season depends on many variables, including fish migration patterns for different species. Most of south-central Alaska's recreational fishing activity is based in the Cook Inlet area. Popular recreational and subsistence fishing locations include the Kenai, Kasilof, Ninilchik, and Susitna Rivers. The Little Suisitna Rivers and Deep Creek are also popular with recreational fishers, and all of these areas contribute greatly to the local economy. Cook Inlet is home to all five Pacific Salmon species, and the open fishing season generally runs from May through September, depending on species and regulation. Cook Inlet also supports recreational fishing seasons for different groundfish and shellfish. The abundant presence of wildlife has prompted development of many wildlife viewing recreational activities, especially for bears on the west side of Cook Inlet and in the Cook Inlet Program Area, in addition to an active hunting industry. From October 2013 to September 2014, fishing and game licenses/tags contributed to $18.1 million in revenue to the State of Alaska. Sea kayaking and charter boats are popular summer tourist activities for scenic and wildlife (e.g., beluga whale) tours. Beluga whale sightings occur along Anchorage's coastal trail. Beluga Point turn out along the Seward Highway, and Turnagain Arm are popular tour bus stops, for beluga whale watching opportunities. Winter recreational activities include snowmachining, skiing, and ice fishing.

14.1.2.2. Recreation and Tourism Employment

Recreation and tourism are major sources of employment in the Cook Inlet region. In 2013, the recreational and tourism industry employed an estimated 21,302 people (**Table C-95**). The MoA accounts for 78.4 percent of tourism-related employment in the Cook Inlet region.

Seasonal fluctuations occur within the recreation and tourism employment sectors, and the summer months of May to September are the peak tourism season. Cruise ship travel in Alaska generally begins in May and runs through the middle of September, directly and indirectly impacting regional employment in the tourism sector.

Within south-central Alaska, which encompasses Mat-Su Borough, the MoA, and KPB, the visitor industry contributed $2.06 billion to the local economy, resulting in a labor impact of $604 million (McDowell Group, 2015).

Table C-95. Number of People Employed in Recreation and Tourism, Upper Cook Inlet Region, 2013 (From: U.S. Census Bureau, 2013).

Sector	Municipality of Anchorage	Kenai Peninsula	Matanuska-Susitna	Upper Cook Inlet Region Total
Sporting goods stores	497	42	91	**630**
Scenic tours	128	92	20 - 99[a]	**240 - 319[b]**
Automotive rental	345	0 - 19[c]	0 - 19[c]	**345 - 383[b]**
Museums and historic sites	162	20 - 99[a]	0 - 19[c]	**182 - 280[b]**
Amusement and recreation	1,767	188	229	**2,184**
Hotels and lodging places	3,309	395	273	**3,977**
RV parks and campsites	20 - 99[a]	20 - 99[a]	0 - 19[c]	**40 - 257[b]**
Eating and drinking places	12,278	1,370	1,670	**15,318**
Total	**18,506 - 18,585**[b]	**2,127 - 2,300**[b]	**2,283 - 2,419**[b]	**22,916 - 23,348**[b]

[a] Estimate of 20 to 99 employees.
[b] Total range using low and high employee estimates.
[c] Estimate of 0 to 19 employees.

14.2. GULF OF MEXICO PROGRAM AREA

14.2.1. Western Planning Area

The western Gulf of Mexico is a popular destination for domestic and foreign tourists. The mild climate and coastal waters provide numerous recreational venues. Beach-going, recreational fishing, boating and diving, nature watching, and other water-based activities are among primary tourist activities.

There are 169 public beaches located on the western Gulf of Mexico's 367 mi of coastline. Gulf of Mexico coastal beaches are particularly popular with visitors. In a typical year, beaches in Texas accommodate nearly 3.9 million visitors. In addition to the beaches, visitors can access the Gulf of Mexico via numerous federal, state, and local parks and wildlife refuges (**Section 9.2**); public and private boat docks and marinas; boat launches; and equipment rental and tour boat companies.

In Texas, PINS is of particular note (**Figure C-104**). PINS consists of >105 km (>65 mi) of undeveloped beach on the barrier island (Padre Island). Over the past 5 years, approximately 560,000 people have visited PINS annually (USDOI, NPS, 2015). Outdoor activities at PINS include birding, kayaking, windsurfing, surfing, and wade fishing.

Tourism is important to the regional economies of the Gulf of Mexico. In 2013, 142,860 workers were employed in the travel and tourism industry in the coastal counties adjacent to the Western Planning Area. During the same time, total industry spending in those coastal counties was approximately $17.3 billion, including $5.3 billion in wages and salaries (U.S. Travel Association, 2013). See **Section 11.2** for more information about regional economic statistics.

Figure C-104. Padre Island National Seashore Location Map (From: USDOI, NPS, 2015).

14.2.2. Central Planning Area

The central Gulf of Mexico is a popular destination for domestic and foreign tourists. As in other areas along the Gulf of Mexico, the mild climate and coastal waters provide opportunities for recreation, including beach-going, recreational fishing, boating and diving, and nature watching.

There are 75 public beaches on 494 mi of coast in the central Gulf of Mexico. In a typical year, beaches along the Central Gulf of Mexico accommodate nearly 2.8 million visitors during nearly 24.5 million annual visitor days (**Table C-96**) (USEPA, n.d.; USDOC, NOAA, 2008). Tourists can access the central Gulf of Mexico via beaches, parks and wildlife refuges, boat docks, marinas, and launches by renting equipment or hiring tour boat companies.

Ship Island, one of five barrier islands in Mississippi, and part of the Gulf Islands National Seashore, is approximately 11 mi south of Gulfport and Biloxi. Ship Island is home to Fort Massachusetts, a beautifully preserved brick fortification completed in 1868. The National Seashore Program is administered by the NPS.

Table C-96. Numbers of Public Beaches, Visitors, and Visitor Days in Coastal Areas of the Central Gulf of Mexico (From: USEPA, n.d.; USDOC, NOAA, 2015).

State/Area	Number of Public Beaches (2010)	Number of Visitors Annually (millions)	Number of Visitor Days (millions)
Alabama	25	1.2	11.8
Louisiana	28	0.6	4.0
Mississippi	22	1.0	8.7
Total	**75**	**2.8**	**24.5**

Tourism has a large economic impact on the central Gulf of Mexico region. In 2013, 232,575 workers were employed in the travel and tourism industry in the coastal counties adjacent to the Central Planning Area. During the same time, total industry spending in those coastal counties was approximately $7.8 billion, which supported $7.9 billion in wages and salaries (U.S. Census Bureau, 2013). See **Section 11.2** for more information about regional economic statistics.

Deepwater Horizon Explosion, Oil Spill, and Response

The *Deepwater Horizon* explosion, oil spill, and response that began on April 20, 2010, impacted the tourism industry in the Gulf of Mexico. The real and perceived impacts of the *Deepwater Horizon* explosion, oil spill, and response to recreational resources curtailed tourism spending immediately after the incident. Tourists' concerns that the *Deepwater Horizon* explosion, oil spill, and response had impacted water quality, the shoreline, and seafood quality, led to a high rate of leisure trip cancellations between April and December 2010 (Oxford Economics, 2010).

The influx of media, relief workers, and government officials to the region during the response and cleanup phase helped offset some, but not all, of the economic activity lost through the reduction in leisure travel (Oxford Economics, 2010). Findings of a 2014 study that conducted field interviews found results from Mobile and Baldwin Counties, Alabama reflected Gulf of Mexico-wide sensibilities, suggesting the media influenced public perception of the impacts of the oil spill in coastal counties (Eastern Research Group, Inc., 2014). Charter boat operations, restaurants, and attractions were affected especially adversely. Casinos, on the other hand were only minimally impacted (Eastern Research Group, Inc., 2014). Eastern Research Group, Inc. (2014) found that the media also had a positive impact, turning public perception once the damage assessment was completed.

Because most economic data are released after a time lag, and given restrictions placed on disclosure of data specific to the *Deepwater Horizon* event due to ongoing litigation, only limited information is available to estimate long-term impacts of the accident to the tourism industry. The concurrence of the *Deepwater Horizon* explosion, oil spill, and response and the national economic recession make analysis of economic impacts of the oil spill to specific industries such as tourism more complex. Several ongoing economic studies are being conducted to estimate the long-term impacts of the *Deepwater Horizon* explosion, oil spill, and response on tourism in the Gulf of Mexico.

14.3. ATLANTIC PROGRAM AREA

The coastline adjacent to the Atlantic Program Area offers a diverse range of marine and coastal habitats, including sandy beaches, barrier islands, estuarine bays and sounds, inland water bodies, maritime forests, and marshland. Barrier island systems with associated recreational beaches exist along much of the coast. These barrier systems consist of sandy strands (barrier islands) that provide recreational beaches open to the Atlantic Ocean, with protected lagoons and marshlands between the barrier island and the mainland. **Table C-97** summarizes the types of recreational activities that occur in various offshore and coastal areas along the Atlantic coast.

The sandy beaches are popular destinations for swimming, sunbathing, and surfing. The lagoons provide a low energy environment for fishing, kayaking, boating, and viewing wildlife. Fishing piers and boat landings are located on both the lagoon and beach sides of the barrier systems. Public beach facilities typically are located on the ocean side of the barrier islands. Golf courses are popular, especially along the coast adjacent to the South Atlantic Planning Area, and typically are located on the mainland, although some are located on barrier islands (e.g., Hilton Head, South Carolina).

Natural harbors and bays of varying sizes are located adjacent to the Atlantic Program Area. These serve as centers of recreational boating and fishing and support activities in the coastal, nearshore, and offshore areas.

Table C-97. Types of Recreational Activities by Location in the Atlantic Program Area.

Location	Recreational Activities
Offshore waters (depths >30 m [10ft])	• Fishing • Diving (very limited; e.g., Monitor National Marine Sanctuary) • Wildlife viewing (e.g., whale watching, pelagic birdwatching)
Nearshore waters (depths <30 m [10 ft])	• Fishing • Boating • Diving (artificial reefs and wrecks; Gray's Reef National Marine Sanctuary) • Wildlife viewing (e.g., whale watching, pelagic birdwatching)
Beaches	• Swimming, snorkeling, surfing • Sunbathing • Fishing • Boating • Wildlife viewing • Camping (e.g., state parks and national seashores)
Lagoons and embayments	• Swimming • Fishing • Boating • Wildlife viewing • Camping
Other coastal areas	• Sightseeing • Golf • Bicycling • Hiking • Hunting

14.3.1. Mid-Atlantic Planning Area

Adjacent to the Mid-Atlantic Planning Area are Chesapeake Bay, Virginia shorelines, and the Outer Banks of North Carolina. Public lands are intermingled with developed areas throughout the region.

There are three National Seashores along the mid-Atlantic coast: Assateague Island, a portion of which is in Virginia, and Cape Hatteras and Cape Lookout in North Carolina. Covering 16,077 ha (39,726 ac), Assateague Island National Seashore straddles Maryland and Virginia. The 12,282-ha (30,350ac) Cape Hatteras National Seashore is best known for the Bodie Island and Cape Hatteras lighthouses. Cape Lookout National Seashore, covering 11,430 ha (28,243 ac), comprises three Outer Bank islands and is known for its wild horses. **Table C-98** lists selected recreational areas along the coasts of Virginia and North Carolina.

Table C-98. Selected Parks, Seashores, Recreational Areas, and Wildlife Refuges along the Mid-Atlantic Coast.

State	Parks, Seashores, Recreational Areas, and Wildlife Refuges
Virginia	• Assateague Island National Seashore • Chincoteague National Wildlife Refuge • Fisherman Island National Wildlife Refuge • Seashore State Park • False Cape State Park
North Carolina	• Wright Brothers National Memorial Park • Cape Hatteras National Seashore • Pea Island National Wildlife Refuge • Cape Lookout National Seashore • Fort Macon State Park • Theodore Roosevelt Natural Area • Hammocks Beach State Park • Jockey's Ridge State Park • Bald Head Island State Natural Area • Theodore Roosevelt State Natural Area • Masonboro Island Coastal Reserve • Freeman Park • Fort Fisher State Recreation Area

14.3.2. South Atlantic Planning Area

Adjacent to the South Atlantic Planning Area are South Carolina's beaches, barrier islands, and coastal marshlands as well as Georgia's sea islands and beaches. Public lands are intermingled with developed areas throughout the region. There is one National Seashore along the coast, Cumberland Island, which covers 14,737 ha (36,415 ac) of the southernmost barrier island in Georgia. Cumberland Island has a rich history extending from the Timucua Indians to the Thomas Carnegie family. **Table C-99** lists selected recreational areas along the coasts of Georgia and South Carolina. These areas are described further in **Section 9.3**, which includes information about national and state parks, seashores, marine sanctuaries, wildlife refuges, and other protected marine areas.

Table C-99. Selected Parks, Seashores, Recreational Areas, and Wildlife Refuges along Coasts Adjacent to the South Atlantic Planning Area.

State	Recreational Area
South Carolina	• Myrtle Beach State Park • Huntingdon Beach State Park • Baruch-North Island Preserve • Edisto Beach State Park • Hunting Island State Park • Cape Roman National Wildlife Refuge
Georgia	• Wassaw National Wildlife Refuge • Blackbeard Island National Wildlife Refuge • Wolf Island National Wildlife Refuge • Wassaw National Wildlife Refuge • Jekyll Island State Park • Cumberland Island National Seashore

Boat-based activities include fishing, diving, sailing, and natural resource viewing. Diving is most popular at the many shipwrecks and artificial reefs in nearshore and, to a lesser extent, offshore waters.

Natural hard bottom areas such as Gray's Reef NMS (2011a) offshore Georgia are also a destination for divers. Additional information regarding Gray's Reef NMS and the other marine sanctuaries located in the South Atlantic Planning Area is included in **Section 9.3**.

Tourism has a large economic impact on the Gulf of Mexico region. In 2013, 96,480 workers were employed in the travel and tourism industry in coastal counties adjacent to the South Atlantic Planning Area. Total 2013 industry spending in those coastal counties was approximately $9.3 billion, which supported $1.4 billion in wages and salaries (U.S. Travel Association, 2013). See **Section 11.3** for more information about regional economic statistics.

15.0 ENVIRONMENTAL JUSTICE

EO 12898 (59 FR 7629) requires federal agencies to take appropriate steps to identify and avoid disproportionately high and adverse effects of federal actions on the health and surrounding environment of minority and low-income populations. CEQ (1997b) guidance for implementation of EO 12898 in the context of NEPA identifies a minority population as an affected area where >50 percent of the population belongs to a minority group, or where the percentage presence of minority groups is meaningfully greater than in the general population.

The analytical methodology has three parts: (1) undertaking a description of the geographic distribution of low-income and minority populations in an affected area; (2) assessing whether oil and gas activities would produce impacts that are high and adverse; and (3) if impacts are high and adverse, determining whether the impacts would disproportionately affect minority and low-income populations.

Routine Activities: Construction and operation of offshore oil and gas development projects could affect environmental justice if any adverse health and environmental impacts resulting from either phase of development were significantly high, and if these impacts disproportionately affect minority and low-income populations. If the analysis determines that health and environmental impacts are not significant, there can be no disproportionate impacts on minority and low-income populations. In the event impacts are significant, disproportionality is determined by comparing the proximity of any high and adverse impacts with the location of low-income and minority populations.

The geographic distribution of minority and low-income groups in the affected area is based on demographic data from the 2013 American Community Survey Census data. Data were collected at the "shoreline" county level for all coastal shoreline counties.

The following definitions were used to define minority and low-income population groups:

Minority. Persons are included in the minority category if they identify themselves as belonging to any of the following groups: (1) Hispanic, (2) Black (not of Hispanic origin) or African American, (3) American Indian or Alaska Native, (4) Asian, or (5) Native Hawaiian or Other Pacific Islander.

Beginning with the 2000 Census, where appropriate, the census form allows individuals to designate multiple population group categories to reflect their ethnic or racial origins. In addition, people who classify themselves as being of multiple racial origin may choose up to six racial groups as the basis of their racial origins. The term minority includes all persons, including those classifying themselves in multiple racial categories, except those who classify themselves as not of Hispanic origin and as White or "Other Race" (U.S. Census Bureau, 2009a).

Poverty. The poverty threshold takes into account family size and age of individuals in the family. In 2014, for example, the poverty line for a family of five with three children below the age of 18 was $28,252. Whereas, the threshold is $12,071 for a single adult (Census Poverty, 2014).

CEQ guidance recommends that minority and low-income populations be identified where either (1) the minority or low-income population of the affected area exceeds 50 percent, or (2) the minority or low-income population percentage of the affected area is greater than the minority population percentage in the general population, or in some other appropriate unit of geographic analysis.

This Programmatic EIS applies both criteria to U.S. Census Bureau data, so that consideration is given to classify a minority population as one >50 percent of the total population, or 20 percent higher than in the state as a whole (the "reference geographic unit").

15.1. ALASKA PROGRAM AREAS

15.1.1. Beaufort Sea and Chukchi Sea Planning Areas

Table C-100. Percent Living Below the Poverty Threshold in Coastal Counties of the Beaufort Sea and Chukchi Sea Planning Areas.

State	Borough	Percent Living Below the Poverty Threshold
AK	Kenai Peninsula Borough	8.6
AK	North Slope Borough	10.3
AK	Northwest Arctic Borough	22.0

15.1.2. Cook Inlet Planning Area

Table C-101. Percent Living Below the Poverty Threshold in Coastal Counties of the Cook Inlet Planning Area.

State	Borough	Census-Designated Place[a]	Percent Living Below the Poverty Threshold
AK	Anchorage	Anchorage	8.3
AK	Kenai Peninsula Borough	Nikiski	5.9
AK	Kenai Peninsula Borough	Salamatof	12.9
AK	Kenai Peninsula Borough	Kenai	9.3
AK	Kenai Peninsula Borough	Soldotna	3.4
AK	Kenai Peninsula Borough	Kalifornsky	3.9
AK	Kenai Peninsula Borough	Cohoe	16.1
AK	Kenai Peninsula Borough	Kasilof	5.6
AK	Kenai Peninsula Borough	Clam Gulch	13.5
AK	Kenai Peninsula Borough	Ninilchik	16.9
AK	Kenai Peninsula Borough	Happy Valley	13.5
AK	Kenai Peninsula Borough	Anchor Point	11.2
AK	Kenai Peninsula Borough	Homer	12.1
AK	Kenai Peninsula Borough	Tyonek	21.7
AK	Kenai Peninsula Borough	Beluga	40.0

[a] The statistical counterparts of incorporated places, and are delineated to provide data for settled concentrations of a population that are identifiable by name, but not legally incorporated.

15.2. GULF OF MEXICO PROGRAM AREA

15.2.1. Western Planning Area

Table C-102. Percent Living Below the Poverty Threshold in Coastal Counties of the Western Planning Area.

State	County	Percent Living Below the Poverty Threshold
TX	Aransas County	19.6
TX	Brazoria County	11.2
TX	Calhoun County	17.6
TX	Cameron County	34.8
TX	Chambers County	9.7
TX	Galveston County	13.3
TX	Harris County	18.5
TX	Jackson County	12.7
TX	Jefferson County	21.0
TX	Kenedy County	32.8
TX	Kleberg County	24.5
TX	Matagorda County	21.1
TX	Nueces County	18.4
TX	Orange County	14.4

Table C-102. Percent Living Below the Poverty Threshold in Coastal Counties of the Western Planning Area. (Continued).

State	County	Percent Living Below the Poverty Threshold
TX	Refugio County	16.2
TX	San Patricio County	17.0
TX	Victoria County	16.9
TX	Willacy County	40.0

15.2.2. Central Planning Area

Table C-103. Percent Living Below the Poverty Threshold in Coastal Counties of the Central Planning Area.

State	County	Percent Living Below the Poverty Threshold
AL	Baldwin County	13.9
AL	Mobile County	19.8
FL	Bay County	14.7
FL	Charlotte County	12.6
FL	Citrus County	16.8
FL	Collier County	14.1
FL	Dixie County	17.4
FL	Escambia County	18.1
FL	Franklin County	20.6
FL	Gulf County	16.4
FL	Hernando County	15.4
FL	Hillsborough County	16.8
FL	Jefferson County	17.2
FL	Lee County	15.4
FL	Leon County	23.2
FL	Levy County	23.7
FL	Liberty County	24.1
FL	Manatee County	15.1
FL	Monroe County	13.5
FL	Okaloosa County	13.4
FL	Pasco County	13.9
FL	Pinellas County	14.1
FL	Polk County	18.2
FL	Santa Rosa County	12.3
FL	Sarasota County	12.2
FL	Taylor County	16.7
FL	Wakulla County	14.4
FL	Walton County	17.9
FL	Washington County	20.1
LA	Ascension Parish	12.3
LA	Assumption Parish	18.7
LA	Calcasieu Parish	17.4
LA	Cameron Parish	8.7
LA	East Baton Rouge Parish	19.2
LA	Iberia Parish	20.7

Table C-103. Percent Living Below the Poverty Threshold in Coastal Counties of the Central Planning Area. (Continued).

State	County	Percent Living Below the Poverty Threshold
LA	Jefferson Davis Parish	18.8
LA	Jefferson Parish	16.5
LA	Lafourche Parish	14.1
LA	Livingston Parish	13.3
LA	Orleans Parish	27.3
LA	Plaquemines Parish	12.7
LA	St. Bernard Parish	18.7
LA	St. James Parish	16.4
LA	St. John the Baptist Parish	16.1
LA	St. Martin Parish	18.2
LA	St. Mary Parish	21.0
LA	St. Tammany Parish	10.6
LA	Tangipahoa Parish	21.2
LA	Terrebonne Parish	17.1
LA	Vermilion Parish	13.5
MS	Hancock County	18.7
MS	Harrison County	19.9
MS	Jackson County	15.9

15.3. ATLANTIC PROGRAM AREA

15.3.1. Mid-Atlantic Planning Area

Table C-104. Percent Living Below the Poverty Threshold in Coastal Counties of the Mid-Atlantic Planning Area.

State	County	Percent Living Below the Poverty Threshold
NC	Beaufort County	21.0
NC	Bertie County	23.4
NC	Brunswick County	16.6
NC	Camden County	6.0
NC	Carteret County	14.4
NC	Chowan County	29.0
NC	Craven County	16.6
NC	Currituck County	9.8
NC	Dare County	8.8
NC	Gates County	19.6
NC	Hertford County	26.0
NC	Hyde County	25.6
NC	Jones County	16.7
NC	New Hanover County	16.9
NC	Onslow County	15.2
NC	Pamlico County	13.8
NC	Pasquotank County	18.4
NC	Pender County	19.3

Table C-104. Percent Living Below the Poverty Threshold in Coastal Counties of the Mid Atlantic Planning Area. (Continued).

State	County	Percent Living Below the Poverty Threshold
NC	Perquimans County	20.2
NC	Pitt County	24.3
NC	Tyrrell County	20.8
NC	Washington County	23.7
VA	Accomack County	20.5
VA	Caroline County	12.7
VA	Charles City County	11.8
VA	Chesapeake	8.5
VA	Chesterfield County	6.7
VA	Essex County	11.1
VA	Gloucester County	9.2
VA	Hampton	14.9
VA	Hanover County	5.1
VA	Isle of Wight County	12.0
VA	James City County	8.7
VA	King and Queen County	9.2
VA	King George County	7.1
VA	King William County	9.5
VA	Lancaster County	11.7
VA	Mathews County	10.1
VA	Middlesex County	9.4
VA	New Kent County	5.9
VA	Newport News	15.2
VA	Norfolk	19.2
VA	Northampton County	24.3
VA	Northumberland County	11.1
VA	Poquoson	5.6
VA	Portsmouth	18.4
VA	Prince George County	8.1
VA	Richmond	25.6
VA	Richmond County	12.8
VA	Spotsylvania County	7.6
VA	Stafford County	5.1
VA	Suffolk	11.4
VA	Surry County	11.5
VA	Virginia Beach	7.9
VA	Westmoreland County	12.9
VA	York County	5.7
VA	Williamsburg	19.5

15.3.2. South Atlantic Planning Area

Table C-105. Percent Living below the Poverty Threshold in Coastal Counties of the South Atlantic Planning Area.

State	County	Percent Living Below the Poverty Threshold
GA	Brantley County	21.9
GA	Bryan County	11.7
GA	Camden County	15.5
GA	Charlton County	19.7
GA	Chatham County	19.1
GA	Glynn County	19.2
GA	Liberty County	24.1
GA	McIntosh County	14.9
GA	Wayne County	22.7
SC	Beaufort County	12.5
SC	Berkeley County	14.4
SC	Charleston County	18.2
SC	Colleton County	20.6
SC	Dorchester County	12.1
SC	Georgetown County	21.2
SC	Hampton County	25.2
SC	Horry County	18.6
SC	Jasper County	23.7

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Appendix D

Impact Screening

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IMPACT SCREENING

Section 1502.1 of the Council on Environmental Quality (CEQ)'s implementation of regulations for the National Environmental Policy Act (NEPA) directs federal agencies to "focus on significant environmental issues." This is done through scoping. Section 1500.4(g) states that scoping should be completed "…not only to identify significant environmental issues deserving of study, but also […] deemphasize insignificant issues." The potential for significant impacts was determined based on evaluation of past Bureau of Ocean Energy Management (BOEM) environmental analyses, public scoping on the resources and potential for impact from the Proposed Action, and internal review by subject matter experts.

In the analysis of direct and indirect effects on each resource area, BOEM determined whether the potential impacts of the Proposed Action may be **negligible**, **minor**, **moderate**, or **major**. Moderate to major effects are discussed in detail in Chapter 4 of the Programmatic Environmental Impact Statement (EIS). Impacts that are expected to be negligible to minor are identified and summarized for each resource area in the following tables, but are not evaluated further in Chapter 4 of the Programmatic EIS.

Air Quality

Impact-Producing Factor	Impact Determination for the Proposed Action	Explanation
Noise		
Noise (seismic, ship, aircraft, drilling, trenching, production, construction, platform removal)	Negligible	No impacts to air quality are expected from noise.
Traffic		
Aircraft Traffic	Negligible	Aircraft/vessel traffic is not expected to affect air quality.
Ship/Vessel Traffic		
Routine Discharges		
Sanitary Wastes	Negligible	Routine discharges are not expected to affect air quality.
Gray Water, Misc. Discharges		
Drilling Mud/Cuttings/Debris		
Bottom/Land Disturbance		
Drilling	Negligible	Bottom/land disturbances from these activities are not expected to affect air quality.
Infrastructure Emplacement (other than noise)		
Pipeline Trenching		
Onshore Construction (other than noise)		
Structure Removal (other than noise)		
Air Emissions		
Onshore	Minor – Moderate	Refer to Section 4.4.1 of the Programmatic EIS.
Offshore		
Lighting		
Onshore Facilities	Negligible	Lighting from onshore/offshore facilities is not expected to affect air quality.
Offshore Facilities		
Visible Infrastructure		
Onshore	Negligible	Onshore/offshore infrastructure is not expected to affect air quality.
Offshore		
Space Use Conflicts		
Onshore Facilities	Negligible	Space use conflicts from onshore/offshore facilities are not expected to affect air quality.
Offshore Facilities		
Non-Routine Events		
Accidental Spills	Minor	Refer to Section 4.4.4 of the Programmatic EIS.
CDE	Moderate	

CDE = Catastrophic Discharge Event; EIS = Environmental Impact Statement.

1 **Water Quality**

Impact-Producing Factor	Impact Determination for the Proposed Action	Explanation
Noise		
Noise (seismic, ship, aircraft, drilling, trenching, production, construction, platform removal)	Negligible	No impacts to water quality are expected from noise.
Traffic		
Aircraft Traffic	Negligible	Vessel wake, propeller "wash", bottom scour from ship/vessel traffic, and channel dredging could lead to increases in turbidity. The amount of turbidity can be mitigated by designation of no-wake and slower speed zones.
Ship/Vessel Traffic		
Routine Discharges		
Sanitary Wastes	Negligible – Minor	Sanitary wastes which undergo treatment and processing prior to discharge are permitted discharges and are not expected to persist in the water column after discharge.
Gray Water, Misc. Discharges		Gray water and other miscellaneous discharges are permitted discharges and are not expected to persist in the water column after discharge.
Drilling Mud/Cuttings/Debris	Negligible – Moderate	Drilling mud, fluids and produced water are permitted discharges that are localized and temporary.
Bottom/Land Disturbance		
Drilling	Minor	Drilling is localized and impacts such as bottom disturbance and discharge of drill cuttings are not expected to occur outside of the immediate area where drilling is occurring.
Infrastructure Emplacement (other than noise)	Negligible – Minor	Bottom disturbance associated with infrastructure emplacement is localized and temporary. Water quality would recover when construction activities are completed and discharges cease because of dilution, settling, and mixing.
Pipeline Trenching		
Onshore Construction (other than noise)		Proper siting of facilities and requirements associated with NPDES construction permits would largely mitigate these impacts.
Structure Removal (other than noise)		Structure removal is temporary and localized. Water quality would return to normal once completed due to settling and mixing.
Air Emissions		
Onshore	Negligible	Onshore/offshore air emissions are not expected to affect water quality.
Offshore		
Lighting		
Onshore Facilities	Negligible	Onshore/offshore lighting from facilities is not expected to affect water quality.
Offshore Facilities		
Visible Infrastructure		
Onshore	Negligible	Onshore/offshore infrastructure is not expected to affect water quality.
Offshore		
Space Use Conflicts		
Onshore Facilities	Negligible	Space use conflicts from onshore/offshore facilities are not expected to affect water quality.
Offshore Facilities		

Impact-Producing Factor	Impact Determination for the Proposed Action	Explanation
Non-Routine Events		
Accidental Spills	Minor – Major	Refer to Section 4.4.4 of the Programmatic EIS.
CDE	Moderate – Major	

CDE = Catastrophic Discharge Event; EIS = Environmental Impact Statement; NPDES = National Pollutant Discharge Elimination System.

Marine Benthic Communities

Impact-Producing Factor	Impact Determination for the Proposed Action	Explanation
Noise		
Noise (seismic, ship, aircraft, drilling, trenching, production, construction, platform removal)	Negligible	The impacts to benthic communities from impulsive sound generated by active acoustic sound sources are not well documented (Moriyasu et al., 2004). Most invertebrates do not perceive sound and any impacts are expected to be negligible.
Traffic		
Aircraft Traffic	Negligible	No traffic impacts to benthic resources are expected during normal operations.
Ship/Vessel Traffic		
Routine Discharges		
Sanitary Wastes	Negligible – Minor	Discharges of sanitary wastes, gray water, bilge, and other miscellaneous discharge are permitted. These discharges are not expected to persist in the water column after discharge and will not have an effect on benthic communities.
Gray Water, Misc. Discharges		
Drilling Mud/Cuttings/Debris	Negligible (overall) Moderate (immediate vicinity of the wells)	Refer to Section 4.4.1.3 of the Programmatic EIS.
Bottom/Land Disturbance		
Drilling	Negligible – Moderate	Refer to Section 4.4.1.3 of the Programmatic EIS.
Infrastructure Emplacement (other than noise)		
Pipeline Trenching		
Onshore Construction (other than noise)	Negligible	Onshore construction will not affect benthic marine environments.
Structure Removal (other than noise)	Negligible – Moderate	Refer to Section 4.4.1.3 of the Programmatic EIS.
Air Emissions		
Onshore	Negligible – Minor	Onshore/offshore air emissions are not expected to directly affect benthic communities.
Offshore		
Lighting		
Onshore Facilities	Negligible	Onshore/offshore lighting is not expected to affect benthic communities.
Offshore Facilities		
Visible Infrastructure		
Onshore	Negligible	Onshore/offshore infrastructure is not expected to affect benthic communities.
Offshore		
Space Use Conflicts		
Onshore Facilities	N/A	N/A
Offshore Facilities		
Non-Routine Events		
Accidental Spills	Minor – Major	Refer to Section 4.4.4 of the Programmatic EIS.
CDE	Moderate – Major	

CDE = Catastrophic Discharge Event; EIS = Environmental Impact Statement; N/A = Not Applicable.

Coastal and Estuarine Habitats

Impact-Producing Factor	Impact Determination for the Proposed Action	Explanation
Noise		
Noise (seismic, ship, aircraft, drilling, trenching, production, construction, platform removal)	N/A	N/A
Traffic		
Aircraft Traffic	N/A	N/A
Ship/Vessel Traffic	Negligible – Minor	Vessel wake, propeller “wash” and associated bottom scour from ship/vessel traffic could contribute to coastal erosion, particularly in the Arctic. Turbidity and sedimentation could result. Channel dredging and expansion would cause mechanical damage, increased turbidity and sedimentation, and removal of some areas of coastal estuarine habitat. Vessel traffic can contribute to accelerated erosion or sedimentation along unprotected shorelines through increased wave activity (Houser, 2010). Vessel traffic associated with all phases of the Gulf of Mexico E&D Scenario has the potential to directly and indirectly affect coastal and estuarine habitats. Vessel traffic impacts can be mitigated by designation of no-wake and slower speed zones. Port Fourchon currently services approximately 90 percent of all deep water rigs and platforms in the Gulf of Mexico (Loren C. Scott and Associates, 2008), and approximately half of all offshore service vessel trips from 2012-2017 are expected to emanate from there (Kaiser, 2015). Port Fourchon has an armored channel so no erosion would occur there. Those channels analyzed in this Programmatic EIS are specifically maintained to directly support oil and gas activities (e.g., Port Fourchon, LA and Corpus Christi/Port Aransas area ports in Texas). Vessel traffic in the Atlantic and Alaska Program Areas would be increased with the Proposed Action somewhat according to the scenario in Chapter 3 of the Programmatic EIS but potential impacts can be mitigated. For the Atlantic and Alaska program areas, limited disturbance may also occur as a result of vessels traveling in the nearshore coastal habitat.
Routine Discharges		
Sanitary Wastes	N/A	N/A
Gray Water, Misc. Discharges		
Drilling Mud/Cuttings/Debris		
Bottom/Land Disturbance		
Drilling	N/A	N/A
Infrastructure Emplacement (other than noise)	N/A	N/A

<table>
<tr><th>Impact-Producing Factor</th><th>Impact Determination for the Proposed Action</th><th>Explanation</th></tr>
<tr><td>Pipeline Trenching</td><td rowspan="2">Negligible – Minor</td><td>Bottom disturbance associated with trenching is usually localized and temporary on OCS and nearshore habitats. It is not expected to result in permanent loss of habitat. In the Gulf of Mexico, Beaufort Sea, and Cook Inlet, production pipelines would generally tie-in to existing distribution pipelines that go to shore. With proper landfall siting to avoid sensitive habitats and proper installation techniques (e.g. directional drilling), impacts to coastal and estuarine habitat should be minimal for any pipelines coming to shore. USACE and state CZM permitting programs would be expected to keep any pipeline landfalls away from sensitive coastal habitats and hold impacts to a minimum.</td></tr>
<tr><td>Onshore Construction (other than noise)</td><td>Onshore construction (other than noise) would probably not be needed in Gulf of Mexico or Cook Inlet, but some onshore support facilities would be expected in the Arctic and Atlantic. For the Arctic and Atlantic Program Areas, construction and operation associated with onshore facilities would result in some removal of coastal habitat and increased vehicular traffic in the vicinity of the facilities. This effect would occur as a result of vehicles associated with construction and operation of the facility (i.e., the commuting facility staff). Limited disturbance may occur as a result of vehicles traveling over the onshore habitat. The presence of additional vehicular traffic would be localized and is not expected to affect the expansive area of coastal and estuarine habitats adjacent to the Atlantic and Alaska program areas. USACE and state CZM permitting programs would be expected to keep any new onshore facilities to a minimum size and out of sensitive coastal habitats.</td></tr>
<tr><td>Structure Removal (other than noise)</td><td>N/A</td><td>N/A</td></tr>
<tr><td colspan="3">Air Emissions</td></tr>
<tr><td>Onshore</td><td rowspan="2">N/A</td><td rowspan="2">N/A</td></tr>
<tr><td>Offshore</td></tr>
<tr><td colspan="3">Lighting</td></tr>
<tr><td>Onshore Facilities</td><td rowspan="2">N/A</td><td rowspan="2">N/A</td></tr>
<tr><td>Offshore Facilities</td></tr>
<tr><td colspan="3">Visible Infrastructure</td></tr>
<tr><td>Onshore</td><td rowspan="2">N/A</td><td rowspan="2">N/A</td></tr>
<tr><td>Offshore</td></tr>
<tr><td colspan="3">Space Use Conflicts</td></tr>
<tr><td>Onshore Facilities</td><td rowspan="2">N/A</td><td rowspan="2">N/A</td></tr>
<tr><td>Offshore Facilities</td></tr>
<tr><td colspan="3">Non-Routine Events</td></tr>
<tr><td>Accidental Spills</td><td>Minor – Major</td><td rowspan="2">Refer to Section 4.4.4 of the Programmatic EIS.</td></tr>
<tr><td>CDE</td><td>Moderate – Major</td></tr>
</table>

CDE = Catastrophic Discharge Event; CZM = Coastal Zone Management; E&D = Exploration and Development; EIS = Environmental Impact Statement; LA = Louisiana; N/A = Not Applicable; OCS = Outer Continental Shelf; USACE = United States Army Corps of Engineers.

Pelagic Communities

Impact-Producing Factor	Impact Determination for the Proposed Action	Explanation
Noise		
Noise (seismic, ship, aircraft, drilling, trenching, production, construction, platform removal)	Negligible – Minor	Under routine operations, some noises that are high in intensity have the potential to cause irreversible damage to marine pelagic organisms that are not capable of avoiding the sounds (i.e., eggs and larvae). However, this impact will occur only in close proximity to the sound source, and is therefore highly localized and will not impact marine pelagic organisms at the population level. Additionally, sublethal impacts would also be small and limited to organisms in close proximity to a sound source and would be reversible once noise returns to ambient levels. Lastly, some sounds will potentially be ignored.
Traffic		
Aircraft and Ship/Vessel Traffic	Negligible	The movement of vessel or air traffic through the area is expected to have, at most, a negligible impact on pelagic communities.
Routine Discharges		
Routine Discharges (sanitary wastes, gray water, miscellaneous discharges)	Minor	Compliance with NPDES permit requirements and USCG regulations would reduce or prevent most impacts on receiving waters caused by routine discharges from normal operations, and any discharges are expected to be diluted rapidly in the water column.
Drilling Mud/Cuttings/Debris		Impacts from drilling muds/cuttings/debris are expected to be localized to the discharge area and minimal and temporary due to the rapid dispersion and dilution of drilling muds and produced water. Additionally, compliance with NPDES permit requirements would reduce or prevent most impacts on receiving waters.
Bottom/Land Disturbance		
Bottom/Land Disturbance (drilling, infrastructure emplacement, pipeline trenching, construction, structure removal)	Negligible – Minor	Bottom disturbance may introduce turbidity and associated decreases in primary productivity. However, these impacts are expected to be temporary and localized.
Air Emissions		
Onshore	Negligible	Air emissions from the proposed action are not expected to affect pelagic communities.
Offshore		
Lighting		
Onshore Facilities	N/A	N/A

Impact-Producing Factor	Impact Determination for the Proposed Action	Explanation
Offshore Facilities	Minor	Platforms illuminate only a small volume of water in the area, thus, increased light irradiance would be localized. Plankton predation by fish and other species can increase around platforms due to illumination at night that would not otherwise occur but additional impacts are minor. Lastly, platforms will be decommissioned and light levels from the platform would return to normal upon removal.
Visible Infrastructure		
Onshore	N/A	N/A
Offshore		
Space Use Conflicts		
Onshore Facilities	N/A	N/A
Offshore Facilities		
Non-Routine Events		
Accidental Spills	Minor – Major	Refer to Section 4.4.4 of the Programmatic EIS.
CDE	Moderate – Major	

N/A = Not Applicable; CDE = Catastrophic Discharge Event; EIS = Environmental Impact Statement; NPDES = National Pollutant Discharge Elimination System; USCG = United States Coast Guard.

Marine Mammals

Impact-Producing Factor	Impact Determination for the Proposed Action	Explanation
Noise		
Seismic Noise	Minor – Moderate	Refer to Section 4.4.1.6 of the Programmatic EIS.
Ship Noise	Minor	
Aircraft Noise	Negligible – Minor (cetaceans) Minor – Moderate (pinnipeds [AK])	Aircraft noise is not expected to have an impact on cetacean species due to the height that aircraft will fly above the water and the fact that most cetaceans are submerged the majority of the time. This does not apply to pinnipeds (e.g., walrus in Alaska) that may have an abrupt and significant startle response to the presence of aircraft. Refer to Section 4.4.1.6 of the Programmatic EIS.
Drilling Noise	Negligible – Minor	This noise will be localized and may result in short-term behavioral impacts. No physical injury or population level impacts are expected.
Trenching Noise		
Production Noise		
Onshore Construction		
Offshore Construction	Minor – Moderate	Refer to Section 4.4.1.6 of the Programmatic EIS.
Platform Removal (includes explosives use)	Negligible – Moderate	
Traffic		
Aircraft Traffic	Negligible – Minor (cetaceans) Minor – Moderate (pinnipeds, polar bears, and sea otters [AK])	See aircraft noise. Refer to Section 4.4.1.6 of the Programmatic EIS.
Ship/Vessel Traffic	Negligible – Moderate	Refer to Section 4.4.1.6 of the Programmatic EIS.
Routine Discharges		
Sanitary Wastes	Negligible – Minor	These are permitted discharges of sanitary wastes, gray water, bilge, etc. These discharges are not expected to persist in the water column after discharge and will not have an effect on marine mammals.
Gray Water, Misc. Discharges		
Drilling Mud/Cuttings/Debris	Negligible – Minor (cetaceans, bears, otters) – Moderate (pinnipeds, some whale and seal species in the Chukchi Sea)	For species that do not feed on the seafloor, negligible to minor impacts are expected because their habitat and food source would not be impacted significantly. Refer to Section 4.4.1.6 of the Programmatic EIS.
Bottom/Land Disturbance		
Drilling	Negligible – Minor	Drilling is localized and impacts such as bottom disturbance and discharge of drill cuttings are not expected to occur outside of the immediate area where drilling is occurring.
Infrastructure Emplacement (other than noise)		Bottom disturbance associated with infrastructure emplacement is localized and temporary. It is not expected to result in loss of habitat or other serious impact.

Impact-Producing Factor	Impact Determination for the Proposed Action	Explanation
Pipeline Trenching	Negligible – Minor	See above.
Onshore Construction (other than noise)		Onshore construction will not affect cetaceans. Pinnipeds, polar bears, and sea otters may be impacted at haul outs or onshore. These impacts are expected to be short-term and localized.
Structure Removal (other than noise)		Structure removal (other than noise) is temporary and localized. Impacts to marine mammals are not expected.
Air Emissions		
Onshore	Negligible – Minor	Onshore/offshore air emissions are not expected to affect marine mammals.
Offshore		
Lighting		
Onshore Facilities	Negligible – Minor	Onshore/offshore lighting is not expected to affect marine mammals.
Offshore Facilities		
Visible Infrastructure		
Onshore	Negligible – Minor	Marine mammals are not impacted by the onshore/offshore viewshed.
Offshore		
Space Use Conflicts		
Onshore Facilities	N/A	N/A
Offshore Facilities		
Non-Routine Events		
Accidental Spills	Minor – Major	Refer to Section 4.4.4 of the Programmatic EIS.
CDE		

AK = Alaska; CDE = Catastrophic Discharge Event; EIS = Environmental Impact Statement; N/A = Not Applicable.

Sea Turtles

Impact-Producing Factor	Impact Determination for the Proposed Action	Explanation
Noise		
Seismic Noise	Negligible – Moderate	Refer to Section 4.4.1.7 of the Programmatic EIS.
Ship Noise	Negligible – Minor	Limited and localized behavioral disturbance and possible auditory masking are anticipated. Generally noise does not propagate at great distances from the vessel, and the source levels are too low to be expected to cause death or injuries such as auditory threshold shifts.
Aircraft Noise		Much of the aircraft noise is reflected and does not penetrate into the water. For sound that does penetrate, the duration is much shorter in water than air. Thus, the effects to sea turtles are limited to disturbance reactions, particularly to a limited number of individuals resting on the sea surface.
Drilling Noise		Drilling noise is localized in the open ocean environment and continuous in nature. Limited behavioral disturbance and possible auditory masking are anticipated; however, individuals are not confined to the area and can move freely away from the area of auditory discomfort.
Trenching Noise		Short term and localized behavioral disturbance.
Production Noise		Limited behavioral disturbance and possible auditory masking are anticipated; however, individuals are not confined to the area and can move freely away from the area of auditory discomfort.
Offshore Construction		Limited behavioral disturbance and possible auditory masking are anticipated; however, individuals are not confined to the area and can move freely away from the area of auditory discomfort.
Onshore Construction		Limited disturbance to nesting females and hatchlings on adjacent nesting beaches associated with construction noise, lighting, etc.
Platform Removal (includes explosives use)	Negligible – Minor (Atlantic) Negligible – Moderate (Gulf of Mexico)	The implementation of existing BSEE guidelines for explosive platform removal would minimize the potential for physical injuries in the Atlantic and Gulf Program areas. Considering the larger number of anticipated removals in the Gulf, the residual risk of disturbance and/or injury to undetected sea turtles within the blast area is higher. Refer to Section 4.4.1.7 of the Programmatic EIS.

Impact-Producing Factor	Impact Determination for the Proposed Action	Explanation
Traffic		
Aircraft Traffic	Negligible – Minor	Projected noise exposure from air traffic operations is expected to be of short duration and limited to minor behavioral disruption to surface oriented individuals.
Ship/Vessel Traffic	Negligible – Moderate	Risk of ship strike will be minimized through implementation of existing guidance for Vessel Strike Avoidance. Seismic vessels survey at slow speeds and while conducting surveys surrounding waters would be monitored during daylight hours by protected species observers for the presence of sea turtles. The anticipated impacts from vessel strike are negligible to minor within the Atlantic program area with the exception of identified high concentration areas located within the designated loggerhead overwintering critical habitat where the impacts are moderate. A higher risk of strike throughout the Gulf of Mexico program area still exists regardless of the vessel strike avoidance mitigations due to higher volume of vessel transits (i.e., survey vessels, support vessels, etc.) and associated longer time periods in which mitigation is not effective (i.e. nighttime transit, heavy sea state, etc.). Refer to Section 4.4.1.7 of the Programmatic EIS.
Routine Discharges		
Sanitary Wastes	Negligible – Minor	These permitted discharges are localized, short term in duration, and are not expected to have a measurable effect on sea turtles.
Gray Water, Misc. Discharges		
Drilling Mud/Cuttings/Debris		
Bottom/Land Disturbance		
Drilling	Negligible – Minor	Drilling is localized and impacts such as bottom disturbance and discharge of drill cuttings are not expected to occur outside of the immediate area where drilling is occurring.
Infrastructure Emplacement (other than noise)		Bottom disturbance associated with infrastructure emplacement is localized and temporary. It is not expected to result in loss of habitat or other serious impact.
Pipeline Trenching		Bottom disturbance associated with trenching is localized and temporary. It is not expected to result in loss of habitat or other serious impact.
Onshore Construction (other than noise)		Onshore construction (other than noise) will not occur on nesting beaches and will not affect nesting sea turtles or hatchlings.
Structure Removal (other than noise)		Structure removal (other than noise) is temporary and localized.
Air Emissions		
Onshore	Negligible – Minor	Onshore/offshore air emissions are not expected to affect sea turtles.
Offshore		
Lighting		
Onshore Facilities	Negligible – Minor	Depending on the location of onshore facilities to nesting beaches, there is the potential for minor impacts to nesting sea turtles and hatchlings.

Impact-Producing Factor	Impact Determination for the Proposed Action	Explanation
Offshore Facilities	Negligible – Minor	Offshore lighting is not expected to affect sea turtles in the water and is located too far offshore to disorient hatchlings.
Visible Infrastructure		
Onshore	N/A	N/A
Offshore		
Space Use Conflicts		
Onshore Facilities	N/A	N/A
Offshore Facilities		
Non-Routine Events		
Accidental Spills	Negligible – Major	Refer to Section 4.4.4 of the Programmatic EIS.
CDE		

BSEE = Bureau of Safety and Environmental Enforcement; CDE = Catastrophic Discharge Event; EIS = Environmental Impact Statement; N/A = Not Applicable.

1 **Marine and Coastal Birds**

Impact-Producing Factor	Impact Determination for the Proposed Action	Explanation
Noise		
Seismic Noise	Minor	Short exposure time. Noise is directed downward towards the seafloor. Localized disturbance/possible temporary displacement from foraging habitat for diving birds lasting no more than a day.
Ship Noise		Short-term and transient effects. Localized disturbance/possible temporary displacement of some species, others may be drawn to follow vessels.
Aircraft Noise		Short-term and transient effects. Localized disturbance/possible temporary displacement, potential for disturbance of breeding birds at colonies which may be mitigated completely by careful selection of flight routes.
Drilling Noise		Short-term and transient effects. Localized disturbance/possible temporary displacement of some marine species.
Trenching Noise		Short-term and transient effects. Localized disturbance/possible temporary displacement of some marine species.
Production Noise		Localized disturbance/possible temporary displacement of some species, other species, such as gulls, may be drawn to platforms and use them for resting.
Offshore Construction		Localized disturbance/possible temporary displacement of some species from the immediate area of activity. Some species may avoid noise and activity, others may become acclimatized and return to the area for the duration of construction activity. Possibly some small loss of foraging habitat for benthic foragers.
Onshore Construction		Localized disturbance/possible temporary displacement of some species from the immediate area of activity. Some species may avoid noise and activity, others may become acclimatized and return to the area for the duration of construction activity. The potential for major impacts to nesting and colonial birds can be mitigated by careful placement of onshore facilities.
Platform Removal (includes explosives use)		Short-term and localized disturbance and temporary displacement of foraging and resting marine species.
Traffic		
Aircraft Traffic	Minor	Short-term and transient effects. Localized disturbance/possible temporary displacement, potential for disturbance of breeding birds at colonies which may be mitigated completely by careful selection of flight routes.
Ship/Vessel Traffic	Minor	Short-term and transient effects. Localized disturbance/possible temporary displacement of some species, others may be drawn to follow vessels.
Routine Discharges		
Sanitary Wastes	Negligible	Discharges of sanitary wastes are regulated. Permitted discharges are not expected to persist in the water column after discharge.

Impact-Producing Factor	Impact Determination for the Proposed Action	Explanation
Gray Water, Misc. Discharges	Negligible	Grey water discharges are regulated. Permitted discharges are not expected to persist in the water column after discharge.
Drilling Mud/Cuttings/Debris	Minor	Discharges of production wastes are regulated. Drilling muds are generally recycled and reused. Cuttings and debris may cover area around the drill site, the size of the area depends upon the depth of the drilling and the size of the mud line cellar. Depending upon the habitat type at the drill site, there may be some temporary loss of benthic foraging habitat until re-colonization occurs, which may take several years.
Bottom/Land Disturbance		
Drilling	Minor	Drilling is localized and occurs in a relatively small area. Drilling operations are temporary and will likely be phased over many years. Cuttings and debris may cover area around the drill site, the size of the area depends upon the depth of the drilling and the size of the mud line cellar. Depending upon the habitat type at the drill site, there may be some temporary loss of benthic foraging habitat until re-colonization occurs, which may take several years.
Infrastructure Emplacement (other than noise)		Temporary disturbance that may trigger avoidance or attraction behaviors by some birds. Platform operation may continue for several decades for production platforms. Each platform covers a relatively small area.
Pipeline Trenching		Short-term and transient effects. Localized disturbance/possible temporary displacement of some marine species, and some potential loss of benthic habitat.
Onshore Construction (other than noise)		Long-term disturbance during production phase due to presence of pipelines and roads, loss of habitat for several decades or longer. Careful placement of facilities can minimize impacts to nesting or colonial species.
Structure Removal (other than noise)		Short-term and localized disturbance and possibly temporary displacement of some species. Careful revegetation of areas after completion of structure removal may minimize any long term loss of coastal habitat.
Air Emissions		
Onshore	Negligible	Air emissions are regulated and permitted releases are not anticipated to impact bird species.
Offshore		

Impact-Producing Factor	Impact Determination for the Proposed Action	Explanation
Lighting		
Onshore Facilities	Minor	Birds are attracted to lights and may be drawn to platforms and other structures. This may lead to energetic costs for individual birds or collisions with platforms or structures. Population level effects are not anticipated, however, any loss of threatened and endangered species, such as eiders, are a concern. Lease stipulations for minimizing light pollution such as down-shielding of lights, using no more light than is necessary for safe operations, selecting LED or other low energy lights which give off less light, etc., may minimize impacts.
Offshore Facilities		Birds are attracted to lights and may be drawn to platforms and vessels. This may lead to energetic costs for individual birds or collisions with platforms or vessels. Russell (2005) estimated that up to 350 birds per year may collide with offshore platforms in the Gulf of Mexico, where there are over 1,400 active platforms. Losses in other planning areas would be expected to be far lower due to the low levels of activity. Population level effects are not anticipated, however, any loss of threatened and endangered species, such as eiders, are a concern. Lease stipulations for minimizing light pollution such as down-shielding of lights, using no more light than is necessary for safe operations, selecting LED or other low energy lights which give off less light, etc., may minimize impacts.
Visible Infrastructure		
Onshore	Minor	Structure will be visible. Collision events are likely to be infrequent, but may occur in foggy conditions or when birds are drawn in by lighting.
Offshore		
Space Use Conflicts		
Onshore Facilities	Minor	Some nesting habitat may be lost and some birds displaced. Careful placement of onshore facilities could minimize this loss.
Offshore Facilities		Some foraging habitat may be lost temporarily, particularly for benthic feeders. The level of displacement is expected to be small in relation to the available foraging area.
Non-Routine Events		
Accidental Spills	Negligible – Major	Refer to Section 4.4.4 of the Programmatic EIS.
CDE	Minor – Major	

CDE = Catastrophic Discharge Event; EIS = Environmental Impact Statement; LED = Light-Emitting Diode.

Fish and Essential Fish Habitat

Impact-Producing Factor	Impact Determination for the Proposed Action	Explanation
Noise		
Noise (seismic, ship, aircraft, drilling, trenching, production, construction, platform removal)	Minor	Some sounds with a very rapid rise and high peak pressure may cause physiological injury to fishes in close proximity to the source, but this type of exposure would be limited to a very small proportion of any population. Localized, temporary behavioral response is the most likely impact resulting from sound-producing OCS activities. Extensive and/or permanent displacement of fishes or masking is not expected as a result of the proposed activities.
Traffic		
Aircraft and Ship/Vessel Traffic	N/A	N/A
Routine Discharges		
Routine Discharges (sanitary wastes, gray water, miscellaneous discharges)	Negligible	Permitted discharges of sanitary wastes (e.g., gray water or bilge) are not expected to persist in the water column after discharge and will not have an effect on fishes or EFH. USEPA and USCG regulations are designed to minimize potential impacts to water quality.
Drilling Mud/Cuttings/Debris		Drilling is localized and discharged muds and cuttings settle or disperse rapidly. Cuttings discharged at the surface spread over a greater area than those shunted to the seafloor, but protective buffers are used to distance drilling activities from potentially sensitive benthic habitat and/or communities. Site specific reviews are conducted and additional mitigations may be applied as appropriate. The effect on fishes and EFH would be negligible.
Bottom/Land Disturbance		
Bottom/Land Disturbance (drilling, infrastructure emplacement, pipeline trenching, construction, structure removal)	Negligible	Bottom disturbances would be small compared to available habitat. Prior to authorizing bottom-disturbing activities, site specific reviews would be conducted to assess potential impacts and recommend appropriate protective measures.
Air Emissions		
Onshore/Offshore	N/A	N/A
Lighting		
Lighting (offshore, onshore facilities)	Negligible	Small areas of marine surface waters could be exposed to facility or vessel lighting, potentially causing a behavioral response in a relatively small number of fish and/or invertebrates. The effect on fishes and EFH would be negligible.
Visible Infrastructure		
Visible Infrastructure (onshore, offshore)	N/A	N/A
Space Use Conflicts		
Space Use Conflicts (onshore, offshore facilities)	N/A	N/A

Impact-Producing Factor	Impact Determination for the Proposed Action	Explanation
Non-Routine Events		
Accidental Spills	Negligible – Moderate	Refer to Section 4.4.4 of the Programmatic EIS.
CDE	Moderate – Major	

CDE = Catastrophic Discharge Event; EIS = Environmental Impact Statement; EFH = Essential Fish Habitat; N/A = Not Applicable; OCS = Outer Continental Shelf; USCG = United States Coast Guard; USEPA = United States Environmental Protection Agency.

Areas of Special Concern

Areas of special concern may experience indirect impacts from the Proposed Action. Habitats and species within the areas of special concern may be directly impacted. Tables C-38, C-39, C-42, and C-43 in **Appendix C** identify areas of special concern within the vicinity of the Program Areas, with reference to the sections in the document that describe impacts to the resources they were designed to protect, where appropriate.

Archaeological and Historical Resources

Impact-Producing Factor	Impact Determination for the Proposed Action	Explanation
Noise		
Noise (seismic, ship, aircraft, drilling, trenching, production, construction, platform removal)	N/A	N/A
Traffic		
Aircraft and Ship/Vessel Traffic	N/A	N/A
Routine Discharges		
Routine Discharges (sanitary wastes, gray water, miscellaneous discharges, drilling mud/cuttings/debris)	N/A	N/A
Bottom/Land Disturbance		
Bottom/Land Disturbance (no archaeological surveys)	Negligible – Major	In the absence of analysis of archaeological survey data prior to the approval of any bottom/land disturbance, BOEM cannot determine if an archaeological or historic resource will be impacted by a proposed activity or the nature and extent of the impact until after the impact has occurred.
Bottom/Land Disturbance (with archaeological surveys)	Negligible – Minor	If an archaeological survey is done to the BOEM standards prior to the approval of any bottom/land disturbance, avoidance mitigation will be put in place for any potential archaeological or historical resource discovered during the survey.
Air Emissions		
Onshore/Offshore	N/A	N/A
Lighting		
Onshore/Offshore facilities	N/A	See comments regarding Visible Infrastructure.
Visible Infrastructure		
Onshore	Negligible – Minor	For most onshore affected resources where a federal agency is funding or approving the construction of an onshore facility, the federal agency is required to evaluate the visual effects of visible infrastructure on the archaeological or historic resource through a NHPA Section 106 process (36 CFR 800).
Offshore		Visible offshore infrastructures will only affect archaeological and historical resources if the facilities are visible from the affected resource, and only if the affected resource obtains its significance from the maritime setting or viewshed properties. Based on the distance from shore for most of the offshore facilities, it is unlikely that an affected resource would lose its significance from the effects of visible infrastructure to such an extent that it will no longer be eligible for listing on the *National Register*; however, these effects will have to be carefully considered at the project level.

<table>
<tr><th>Impact-Producing Factor</th><th>Impact Determination for the Proposed Action</th><th>Explanation</th></tr>
<tr><td colspan="3">Space Use Conflicts</td></tr>
<tr><td>Space Use Conflicts (onshore, offshore facilities)</td><td>N/A</td><td>N/A</td></tr>
<tr><td colspan="3">Non-Routine Events</td></tr>
<tr><td>Accidental Spills</td><td rowspan="2">Negligible – Moderate</td><td rowspan="2">Refer to Section 4.4.4 of the Programmatic EIS.</td></tr>
<tr><td>CDE</td></tr>
</table>

BOEM = Bureau of Ocean Energy Management; CDE = Catastrophic Discharge Event; CFR = Code of Federal Regulations; EIS = Environmental Impact Statement; N/A = Not Applicable; NHPA = National Historic Preservation Act.

Population, Employment, and Income

Impact-Producing Factor	Impact Determination for the Proposed Action	Explanation
Routine Operations		
Routine Operations (inclusive of all exploration, development, production, and decommissioning activities and operations)	Negligible – Moderate (Beaufort and Chukchi Seas) Negligible – Minor (Cook Inlet, Gulf of Mexico, Atlantic)	Employment and associated labor income impacts from routine operations are expected to be positive contributions to the affected local and state economies. Increases in population can have both positive and negative impacts on social systems. Possible negative impacts from rapid population increases, particularly in remote areas, can include strains on public infrastructure such as local housing, roads, schools, emergency response facilities, and utilities. The impacts to local and state populations associated with increased employment from routine activities are expected to be negligible to minor for the Gulf of Mexico, Atlantic, and Cook Inlet Program Areas and negligible to moderate for the Beaufort and Chukchi Seas Program Areas. Refer to Section 4.4.1.12 of the Programmatic EIS.
Non-Routine Events		
Accidental Spills	Minor – Major	Oil spills could have negative impacts on local and state employment and labor income. Refer to Section 4.4.4 of the Programmatic EIS
CDE	Moderate – Major	

CDE = Catastrophic Discharge Event; EIS = Environmental Impact Statement.

Land Use and Infrastructure

Impact-Producing Factor	Impact Determination for the Proposed Action	Explanation
Noise		
Seismic Noise		Noise impacts relating to marine seismic surveys and geohazard surveys would be restricted to the offshore environment. It is not anticipated that noise from seismic surveys will impact onshore land uses and infrastructure.
Ship Noise		Vessel noise (e.g., propeller cavitation, propeller singing, propulsion) would be restricted to the offshore environment. It is not anticipated that ship noise will impact onshore land uses and infrastructure.
Aircraft Noise		Aircraft noise (e.g., helicopters) would be limited to coastal areas where oil and gas activities are already in place. It is not anticipated to impact onshore land use and infrastructure.
Drilling Noise	Negligible	Noise from drilling operations would be restricted to the offshore environment. It is not anticipated that drilling noise would impact onshore land use and infrastructure.
Trenching Noise		Noise from pipeline trenching would be restricted to coastal areas where oil and gas activities are already taking place. It is not anticipated that trenching noise would impact onshore land use and infrastructure.
Production Noise		Production noise (similar in frequency to drilling noise) would primarily be restricted to the offshore environment. It is not anticipated that production noise would impact onshore land use and infrastructure.
Offshore Construction		Offshore construction noise (e.g., vessel, equipment) would be restricted to the offshore environment and temporary. It is not anticipated that offshore construction noise would impact onshore land use and infrastructure.
Onshore Construction	Negligible – Minor	Onshore construction noise (e.g., new landfalls, port expansion) would be temporary to support new construction or expand existing infrastructure. It is anticipated that onshore construction of oil and gas infrastructure will occur in more industrial areas, and that noise impacts will be temporary. As such, it is not anticipated that onshore construction noise would impact land use and infrastructure.
Platform Removal (includes explosives use)	Negligible	Platform removal noise (explosive severance) would be restricted to the offshore environment. It is not anticipated that noise from platform removal would impact onshore land use and infrastructure.
Traffic		
Aircraft Traffic	Negligible	Aircraft traffic is expected to follow USDOT and FAA guidance over land, which recommends a minimum altitude of 2,000 ft (610 m) when flying over noise sensitive areas such as national parks, wildlife refuges, and wilderness areas. It also is not anticipated that aircraft traffic will increase significantly or impact onshore land use and infrastructure.

Impact-Producing Factor	Impact Determination for the Proposed Action	Explanation
Ship/Vessel Traffic	Negligible – Minor	Support-vessel traffic is estimated to consist of one to three trips per platform per week from the shore base. If barges are used to transport the drill cuttings and spent mud from production wells during drilling operations, a dedicated barge could make one to two trips per week to an onshore disposal facility. While the Proposed Action may increase number of ships offshore to support oil and gas activities, it is not expected that ship traffic will be inconsistent with onshore land uses and infrastructure.
Routine Discharges		
Sanitary Wastes	Negligible – Minor	Sanitary waste is routinely treated by means of a marine sanitation device. Wastewater treatment sludge and other associated wastes will be transported to shore for disposal at an approved facility. As such, it is not anticipated that treatment of wastes onshore will be inconsistent with local land use and infrastructure.
Gray Water, Misc. Discharges	Negligible	Miscellaneous discharges (e.g., deck drainage, ballast water) will be restricted to the offshore environment and are not expected to impact onshore land use and infrastructure.
Drilling Mud/Cuttings/Debris		Drilling mud/cuttings/debris are expected to be localized, short term, and restricted to the offshore environment. As such, impacts to onshore land use and infrastructure are not expected.
Bottom/Land Disturbance		
Drilling	Negligible	Physical disturbance of the seafloor from drilling will be limited to the proximal area where the wellbore penetrates the substrate. It is not anticipated that drilling will impact onshore land use and infrastructure
Infrastructure Emplacement (other than noise)	Negligible – Minor	Bottom disturbance associated with offshore infrastructure emplacement would be localized and temporary. It is not expected that infrastructure emplacement would be inconsistent with onshore land uses and infrastructure.
Pipeline Trenching		Trenching for pipeline burial causes displacement or resuspension of seafloor sediments. It is not expected that pipeline trenching in the offshore environment will impact onshore land uses and infrastructure.
Onshore Construction (other than noise)	Minor (Cook Inlet) Minor – Moderate (Gulf of Mexico, Atlantic) Moderate (Beaufort and Chukchi Seas)	Refer to Section 4.4.1.13 of the Programmatic EIS.
Structure Removal (other than noise)	Negligible – Minor	Bottom and land disturbing activities resulting from the removal of offshore platforms will be limited to the proximal area. Structure removal is not expected to impact onshore land use and infrastructure.

Impact-Producing Factor	Impact Determination for the Proposed Action	Explanation
Air Emissions		
Onshore	Negligible – Minor	Impacts from onshore air emissions are expected to be site-specific and are subject to USEPA requirements for NAAQS. It is not expected that air emissions from routine operations will impact onshore land uses and infrastructure.
Offshore		BOEM and USEPA regulate air emissions on the OCS. As lease-specific plans are submitted for review, best available control technology will be put in place to minimize air quality impacts from activities in the offshore environment. As such, it is not expected that air emissions offshore will impact onshore land uses and infrastructure.
Lighting		
Onshore Facilities	Negligible – Minor	Lighting from onshore facilities (e.g., ports, construction facilities, transportation, processing facilities) will be site-specific and largely in areas where oil and gas activities are already taking place. It is not expected that lighting from onshore facilities will be inconsistent with onshore land uses and infrastructure.
Offshore Facilities		Lighting from offshore facilities (e.g., platform lighting, construction lighting, MODU) will mostly impact nighttime views. It is not expected that lighting from offshore facilities will be inconsistent with onshore land uses and infrastructure.
Visible Infrastructure		
Onshore	Minor (Gulf of Mexico, Atlantic, Cook Inlet)	Refer to Section 4.4.1.13 of the Programmatic EIS.
Offshore	Minor – Moderate (Beaufort and Chukchi Seas, Cook Inlet)	
Space Use Conflicts		
Onshore Facilities	Minor (Gulf of Mexico)	Refer to Section 4.4.1.13 of the Programmatic EIS.
Offshore Facilities	Minor – Moderate (Beaufort and Chukchi Seas, Atlantic)	
Non-Routine Events		
Accidental Spills	Minor – Moderate	Refer to Section 4.4.4 of the Programmatic EIS.
CDE	Minor – Major	

BOEM = Bureau of Ocean Energy Management; CDE = Catastrophic Discharge Event; EIS = Environmental Impact Statement; FAA = Federal Aviation Administration; MODU = Mobile Offshore Drilling Unit; NAAQS = National Ambient Air Quality Standards; OCS = Outer Continental Shelf; USDOT = United States Department of Transportation; USEPA = United States Environmental Protection Agency.

Commercial and Recreational Fisheries

Impact-Producing Factor	Impact Determination for the Proposed Action	Explanation
Noise		
Seismic Noise	Negligible – Minor	Impacts would be minor due to proximity and seasonality to fishes and various life stages.
Ship Noise	Negligible	Vessel noise would result in a small incremental increase to overall acoustic habitat.
Aircraft Noise		Aircraft noise is not expected to have an impact on commercial and recreational fisheries and results in limited propagation in the water column.
Drilling Noise	Minor	Drilling noise is spatially limited and is not expected to displace fishing activity.
Trenching Noise	Negligible – Minor	This noise should be very localized and is not expected to displace fishing activity.
Production Noise	N/A	N/A
Offshore Construction	Negligible	Could promote short term avoidance but following activity it is likely fishing will return to the area.
Onshore Construction	N/A	N/A
Platform Removal (includes explosives use)	Negligible – Minor	The most likely impact on fishes (and their associated fisheries) would be changes in behavior (e.g., avoidance responses); however, fish are expected to return to normal behavior patterns once the impacts are removed. Due to the relatively low numbers of explosive removals expected, the proposed numbers of fish killed by explosives are not expected to result in population-level effects.
Traffic		
Aircraft Traffic	N/A	N/A
Ship/Vessel Traffic		Vessel traffic is addressed in space use conflict.
Routine Discharges		
Sanitary Wastes	N/A	N/A
Gray Water, Misc. Discharges	Negligible	Negligible due to existing discharge regulations which protect fisheries by upholding water quality standards.
Drilling Mud/Cuttings/Debris		Negligible impacts to bottom set commercial fisheries gear due to localized impacts.
Bottom/Land Disturbance		
Drilling	Negligible – Minor	Drilling is localized and impacts such as bottom disturbance and discharge of drill cuttings are not expected to occur outside of the immediate area where drilling is occurring.
Infrastructure Emplacement (other than noise)		Bottom disturbance associated with infrastructure emplacement is localized and temporary. It is not expected to result in loss of habitat or other serious impact.
Pipeline Trenching	Negligible	Pipeline trenching is limited spatially and not expected to cause adverse effects to commercial and recreational fisheries.
Onshore Construction (other than noise)	N/A	N/A

Impact-Producing Factor	Impact Determination for the Proposed Action	Explanation
Structure Removal (other than noise)	Negligible – Minor	In the event that explosive severance methods are employed during decommissioning, localized mortality of fishes associated with the structure is expected. This could affect recreational or commercial landings in the vicinity of the activity, but would have no effect on overall landings.
Air Emissions		
Onshore	N/A	Onshore/offshore air emissions are not expected to affect commercial and recreational fisheries.
Offshore		
Lighting		
Onshore Facilities	N/A	N/A
Offshore Facilities	Negligible	Some fishers may benefit from targeting fishes foraging in surface waters affected by the light field associated with the offshore facility, but overall landings are not expected to increase due to fisheries management actions.
Visible Infrastructure		
Onshore	N/A	N/A
Offshore		
Space Use Conflicts		
Onshore Facilities	N/A	N/A
Offshore Facilities	Negligible – Minor	Offshore facilities and activities are not expected to have long-term negative effects on fisheries resources. The area available for fishing will not be appreciably reduced due to the low number of structures that may be emplaced relative to the overall area of the OCS. In addition, the transient nature of exploration activities such as seismic surveys means that the potential impact to fisheries will be minimal and conditions are expected to return to normal after activities cease.
Non-Routine Events		
Accidental Spills	Negligible – Major	Refer to Section 4.4.4 of the Programmatic EIS.
CDE	Moderate – Major	

CDE = Catastrophic Discharge Event; EIS = Environmental Impact Statement; N/A = Not Applicable.

Tourism and Recreation

Impact-Producing Factor	Impact Determination for the Proposed Action	Explanation
Noise		
Noise	Minor (Gulf of Mexico, Atlantic, Cook Inlet) Moderate (Beaufort and Chukchi Seas)	Routine OCS traffic can cause disturbances to recreational resources, particularly beaches, through increased levels of noise from additional helicopter and vessel traffic. This would add a low level of noise pollution that could affect beach users in the Gulf of Mexico. With the requirement of a 50-mi (80.5-km), no-leasing buffer from the coastline in the Atlantic, most noise associated with oil and gas activities would be far from these resources. However, there would likely be an increase in vessel traffic from shore, resulting in a small increase in noise levels and ship traffic. Offshore noise is not expected to have an impact to recreation and tourism in the Gulf of Mexico, Atlantic, and Cook Inlet Program Areas. Refer to Section 4.4.1.15 of the Programmatic EIS.
Traffic		
Aircraft and Ship/Vessel Traffic	Negligible – Minor	There may be minor space use conflicts with recreational fishers surrounding additional traffic in the Gulf of Mexico and the Atlantic during the initial phases of the Proposed Action and low-level environmental degradation of fish habitat, which could affect recreational fishing activity. However, these negative effects could be outweighed by the beneficial role that offshore structures serve, as artificial reefs for fish populations. In the Atlantic, Gulf, and Cook Inlet Program Areas, the primary activity that will take place in nearshore waters related to oil and gas operations will involve supply boats and helicopters carrying crew and supplies. Some noise may be detectable from recreational areas located within proximity to a port of call used by the industry. Offshore platforms, facility construction and vessel traffic associated with personnel and resupply efforts could increase the number of water vessels within the Cook Inlet at any one time during peak tourism season.
Routine Discharges		
Routine Discharges (sanitary wastes, gray water, miscellaneous discharges)	Negligible	Compliance with NPDES permit requirements and USCG regulations would reduce or prevent most impacts on receiving waters caused by routine discharges from normal operations; discharges are expected to be diluted rapidly in the water column.
Drilling Mud/Cuttings/Debris		Impacts from drilling muds/cuttings/debris are expected to be localized to the discharge area and minimal and temporary due to the rapid dispersion and dilution of drilling muds and produced water. Additionally, compliance with NPDES permit requirements would reduce or prevent most impacts on receiving waters.

Impact-Producing Factor	Impact Determination for the Proposed Action	Explanation
Bottom/Land Disturbance		
Bottom/Land Disturbance (drilling, infrastructure emplacement, pipeline trenching, construction, structure removal)	Negligible	Bottom disturbance is not expected to have an impact on recreation and tourism.
Air Emissions		
Air Emissions (onshore, offshore)	Negligible – Minor	In the Alaska Program Areas, air emissions resulting from E&D activities would be localized to the area of operations and are not anticipated to increase air pollutant levels to the degree where tourism and recreational industries witness a discernable impact.
Lighting		
Lighting (onshore, offshore facilities)	Negligible-Minor (Gulf of Mexico, Atlantic, Cook Inlet) Minor – Moderate (Beaufort and Chukchi Seas)	While lighting could be considered an impacting factor for recreation and tourism, in the Gulf of Mexico the existing oil and gas industry infrastructure and operations have been productive since the 1940s. The Proposed Action is not expected to result in considerable new lighting. In the Atlantic, vessels involved in oil and gas activities would likely operate out of existing onshore support bases. Within Cook Inlet, existing onshore and offshore facilities and activities make it unlikely that additional lighting would have more than minor impacts. Refer to Section 4.4.1.15 of the Programmatic EIS for a discussion of the Beaufort and Chukchi Seas Program Areas.
Visible Infrastructure		
Onshore Facilities	Negligible (Gulf of Mexico, Atlantic, Cook Inlet) Minor (Beaufort and Chukchi Seas)	Onshore facilities are not expected to have noticeable impacts on recreation and tourism in the Gulf of Mexico, Atlantic, and Cook Inlet Program Areas because of existing infrastructure in the Gulf of Mexico and Cook Inlet in state and federal waters; and the distance from shore in the Atlantic. Only minor effects on tourism and recreation are expected in the Beaufort and Chukchi Seas Program Areas, because there is little development in these remote areas and some small impacts may be more noticeable in such remote locations.
Offshore Facilities		Lighting from offshore facilities is not expected to have noticeable impacts on recreation and tourism in the Gulf of Mexico, Atlantic, and Cook Inlet Program Areas because of existing infrastructure in the Gulf of Mexico and Cook Inlet in state and federal waters; and the distance from shore in the Atlantic. Only minor effects on tourism and recreation are expected in the Beaufort and Chukchi Seas Program Areas, because there is little development in these remote areas and some small impacts may be more noticeable in such remote locations.

Impact-Producing Factor	Impact Determination for the Proposed Action	Explanation
Visible Infrastructure (onshore, offshore)	Negligible (Gulf of Mexico, Atlantic, Cook Inlet) Minor (Beaufort and Chukchi Seas)	While onshore activity is outside BOEM jurisdiction, it is assumed that state and local officials will adhere to local planning laws and ordinances. Given the existing extensive and widespread support system for the OCS oil and gas related industry and its associated labor force the effects are expected to be widely distributed, and would not change the already existing infrastructure in the Gulf of Mexico. In the Atlantic, the 50 mile buffer will make visible infrastructure offshore negligible. Existing levels of infrastructure in the Atlantic region and in Cook Inlet also means that additional facilities associated with the Proposed Action would have negligible impacts. Refer to Section 4.4.1.15 of the Programmatic EIS for a discussion of the Beaufort and Chukchi Seas Program Areas.
Space Use Conflicts		
Space Use Conflicts (onshore, offshore facilities)	Negligible – Minor	In the Beaufort and Chukchi Seas Program Areas, space use conflicts are related to the current limited availability for temporary lodging. The transitory nature of crew rotations associated with drilling and development activities and the limited lodging options, and predominantly small vacancy rates, could create lodging conflicts for travelers and visitors to the North Slope during peak tourism seasons. The number of E&D vessels within the relatively confined nature of Cook Inlet has the potential for space use conflicts with recreational activities such as fishing and sightseeing. These impacts could be minor with proper mitigation and public collaboration.
Non-Routine Events		
Accidental Spills	Minor – Major	Refer to Section 4.4.4 of the Programmatic EIS.
CDE	Moderate – Major	

BOEM = Bureau of Ocean Energy Management; CDE = Catastrophic Discharge Event; E&D = Exploration and Development; EIS = Environmental Impact Statement; NPDES = National Pollutant Discharge Elimination System; OCS = Outer Continental Shelf; USCG = United States Coast Guard.

Sociocultural Systems

Impact-Producing Factor	Impact Determination for the Proposed Action	Explanation
Noise		
Seismic Noise	Negligible – Minor (Gulf of Mexico, Atlantic, Cook Inlet) Minor – Moderate (Beaufort and Chukchi Seas)	Seismic noise in the Gulf of Mexico, Atlantic, and Cook Inlet is expected to produce a negligible or minor impact to sociocultural systems due to the location of seismic operations relative to sociocultural system resources and/or the species present. Refer to Section 4.4.1.16 of the Programmatic EIS.
Ship Noise	Minor	Ship noise is short-term and transient. While localized disturbance and possible temporary displacement of some species is possible, impacts of ship noise to sociocultural systems is expected to be minor.
Aircraft Noise		Aircraft noise is short-term and transient. While localized disturbance and possible temporary displacement of some species is possible, impacts of aircraft noise to sociocultural systems is expected to be minor.
Drilling Noise	Negligible – Minor (Gulf of Mexico, Atlantic, Cook Inlet) Minor – Moderate (Beaufort and Chukchi Seas)	Noise from drilling operations would be restricted to the offshore environment. In the Gulf of Mexico, Atlantic, and Cook Inlet, drilling noise is expected to produce negligible to minor impacts to sociocultural systems. In the Beaufort and Chukchi Seas, anthropogenic noise (including drilling noise) is limited. Refer to Section 4.4.1.16 of the Programmatic EIS.
Trenching Noise	Minor	See discussion of drilling noise, above.
Production Noise		Production noise has been at minor levels in the Gulf of Mexico and Cook Inlet for many years and would be expected to be the same in the Atlantic, the Beaufort Sea, and Chukchi Sea Program Areas.
Onshore Construction	Negligible – Minor	This noise should be very localized and proximate to existing infrastructure and therefore negligible in the Gulf of Mexico, Atlantic, and Cook Inlet.
Offshore Construction	Minor	See discussion of ship and production noise.
Platform Removal (includes explosives use)	Negligible – Minor (Gulf of Mexico, Atlantic, Cook Inlet) Minor – Moderate (Beaufort and Chukchi Seas)	Noise associated with platform removal in the Gulf of Mexico, Atlantic, and Cook Inlet is expected to produce a negligible or minor impact to sociocultural systems due to the location of removal operations relative to sociocultural system resources and/or the species present. Refer to Section 4.4.1.16 of the Programmatic EIS.
Traffic		
Ship/Vessel Traffic	Negligible – Major	In the Gulf of Mexico, Atlantic, and Cook Inlet, ship and vessel traffic will have only a negligible impact to sociocultural systems because the traffic increase will not be measurably different than the baseline. In the Beaufort and Chukchi Seas, subsistence hunting of marine mammals is central to the culture of the Iñupiat; the effects that vessel traffic have on marine mammals would be the same as for subsistence, negligible to major effects (see the section on marine mammals). Refer to Section 4.4.1.16 of the Programmatic EIS.

Impact-Producing Factor	Impact Determination for the Proposed Action	Explanation
Aircraft Traffic	Negligible – Minor	In the Gulf of Mexico, Atlantic, and Cook Inlet, aircraft traffic will have only a negligible impact because the traffic increase will not be measurably different than the baseline. In the Arctic, the effects for aircraft traffic on subsistence would be minor due to target species (beluga, bowhead) activity patterns and duration of aircraft activity.
Routine Discharges		
Sanitary Wastes	Minor	Sanitary wastes, as well as other routine discharges, will not persist in the water column after discharge for all planning areas.
Gray Water, Misc. Discharges		
Drilling Mud/Cuttings/Debris	Minor – Moderate	Refer to Section 4.4.1.16 of the Programmatic EIS.
Bottom/Land Disturbance		
Drilling	Negligible	This IPF is localized and does not have a relationship with sociocultural resources or marine recreation, beach activities, or marine subsistence; the effect of drilling-associated bottom/land disturbance on sociocultural system resources is negligible.
Infrastructure Emplacement (other than noise)		
Pipeline Trenching		
Onshore Construction (other than noise)	Negligible (Gulf of Mexico, Atlantic, Cook Inlet) Moderate – Major (Beaufort and Chukchi Seas)	The effects of onshore construction to sociocultural systems is considered to be negligible in the Gulf of Mexico, Atlantic and Cook Inlet because there is already sufficient infrastructure to tie into that there will not be a change above existing conditions. See Section 4.4.1.16 of the Programmatic EIS.
Structure Removal (other than noise)		The effects of structure removal to sociocultural systems is considered to be negligible in the Gulf of Mexico, Atlantic and Cook Inlet because there is already sufficient activity there will not be a change above existing conditions. See Section 4.4.1.16 of the Programmatic EIS for a discussion of the Beaufort and Chukchi Seas Program Areas
Air Emissions		
Onshore	Negligible	Air emissions associated with the Proposed Action will not adversely affect subsistence and recreational fishing activities or other sociocultural systems resources. Consequently, only negligible impacts to sociocultural systems are expected.
Offshore		

Impact-Producing Factor	Impact Determination for the Proposed Action	Explanation
Lighting		
Onshore Facilities	Negligible	Lighting does not have any measureable effect to sociocultural systems above existing conditions; overall impact of onshore/offshore lighting is negligible.
Offshore Facilities		
Visible Infrastructure		
Onshore	Negligible	Onshore visible infrastructure has existed in the Gulf of Mexico and Cook Inlet for many years and has had negligible effects. Onshore infrastructure could be located in a way to not affect sociocultural resources above a negligible level. A similar approach could be employed in the Atlantic Program Area because of the existing level and density of industrial and commercial development. In the Gulf of Mexico, Atlantic, and Cook Inlet, expected infrastructure would tie into existing infrastructure. Therefore, the impact of this IPF would be negligible in the Gulf of Mexico, Atlantic, and Cook Inlet. Onshore oil and gas infrastructure is visible from the village of Nuiqsut near the Beaufort Sea, resulting in negligible impact; a similar level of impact is expected for onshore infrastructure in the Chukchi Sea Program Area because it has a similar, undeveloped treeless tundra terrain.
Offshore	Negligible – Minor (Gulf of Mexico, Atlantic, Cook Inlet) Moderate – Major (Beaufort and Chukchi Seas)	The Atlantic Program Area is too far offshore to be visible and potential effects are therefore negligible. Visible offshore infrastructure in the Gulf of Mexico and Cook Inlet has been present for several decades; impacts of visible infrastructure are expected to range from negligible to minor. Refer to Section 4.4.1.16 of the Programmatic EIS.
Space Use Conflicts		
Onshore Facilities	Negligible (Gulf of Mexico, Atlantic, Cook Inlet) Moderate – Major (Beaufort and Chukchi Seas)	In the Atlantic, offshore facilities are located too far offshore to produce impact to sociocultural systems. Existing infrastructure in the Gulf of Mexico and Cook Inlet and the low number of potential facilities associated with this Program makes it unlikely that there will be a noticeable change above existing conditions. See Section 4.4.1.16 of the Programmatic EIS for a discussion of the Beaufort and Chukchi Seas Program Areas.

Impact-Producing Factor	Impact Determination for the Proposed Action	Explanation
Offshore Facilities	Negligible (Gulf of Mexico, Atlantic, Cook Inlet) Moderate – Major (Beaufort and Chukchi Seas)	The impacts of onshore facilities will be localized and will not result in a noticeable change over the existing conditions in the Cook Inlet, Atlantic, and Gulf of Mexico Program Areas. See Section 4.4.1.16 of the Programmatic EIS for a discussion of the Beaufort and Chukchi Seas Program Areas.
Non-Routine Events		
Accidental Spills	Minor – Major	Refer to Section 4.4.4 of the Programmatic EIS.
CDE	Moderate – Major	

CDE = Catastrophic Discharge Event; EIS = Environmental Impact Statement; IPF = Impact Producing Factor.

Environmental Justice

Impact-Producing Factor	Impact Determination for the Proposed Action	Explanation
Noise		
Seismic Noise	Minor – Major (Beaufort and Chukchi Seas) Minor (Cook Inlet, Gulf of Mexico and Atlantic)	Subsea surface noise will not produce a direct impact on vulnerable communities onshore, but could affect their subsistence harvests nearshore. In the Atlantic, communities relying solely on subsistence harvests would be unlikely to travel past the 50 mile buffer. In the Gulf of Mexico, communities relying solely on subsistence harvests have done so in tandem with the offshore oil industry since 1947. Refer to Section 4.4.1.17 of the Programmatic EIS.
Ship Noise		
Aircraft Noise		
Drilling Noise	Negligible – Major (Beaufort and Chukchi Seas) Negligible – Minor (Cook Inlet, Gulf of Mexico and Atlantic)	
Trenching Noise		
Production Noise		
Offshore Construction		
Onshore Construction	Minor – Major (Beaufort and Chukchi Seas) Minor (Cook Inlet, Gulf of Mexico and Atlantic)	While onshore activity is outside BOEM jurisdiction, it is assumed that state and local officials will adhere to local planning laws and ordinances; only minor impacts from onshore construction noise are expected to Gulf of Mexico and Atlantic communities recognized under this resource area. Refer to Section 4.4.1.17 of the Programmatic EIS.
Platform Removal (includes explosives use)		Please see above and refer to Section 4.4.1.17 of the Programmatic EIS.
Traffic		
Aircraft Traffic	Negligible – Major (AK) Negligible – Minor (Gulf of Mexico and Atlantic)	In the Atlantic, communities relying solely on subsistence harvests would be unlikely to travel past the 50-mile buffer. In the Gulf of Mexico, communities relying solely on subsistence harvests have done so in tandem with the offshore oil industry since 1947. Limited interaction with OCS-associated vessel traffic in coastal waters is expected. Impacts to vulnerable coastal communities in these areas are expected to be minor. Refer to Section 4.4.1.17 of the Programmatic EIS.
Ship/Vessel Traffic	Minor – Major (AK) Minor (Gulf of Mexico and Atlantic)	
Routine Discharges		
Sanitary Wastes	Negligible – Moderate (Beaufort and Chukchi Seas) Negligible – Minor (Cook Inlet, Gulf of Mexico and Atlantic)	Routine (permitted) offshore discharges are unlikely to directly impact vulnerable communities onshore, but could affect their subsistence harvests nearshore. In the Atlantic, communities relying solely on subsistence harvests would be unlikely to travel past the 50-mile buffer. In the Gulf of Mexico, communities relying solely on subsistence harvests have done so in tandem with the offshore oil industry since 1947. Refer to Section 4.4.1.17 of the Programmatic EIS.
Gray Water, Misc. Discharges	Minor – Moderate (Beaufort and Chukchi Seas) Minor (Cook Inlet, Gulf of Mexico and Atlantic)	
Drilling Mud/Cuttings/Debris		

Impact-Producing Factor	Impact Determination for the Proposed Action	Explanation
Bottom/Land Disturbance		
Drilling	Negligible (Gulf of Mexico and Atlantic) Minor (Cook Inlet) Moderate – Major (Beaufort and Chukchi Seas)	Assuming that proper mitigation would be in place (e.g., time area closures), it is unlikely that vulnerable communities in the Beaufort and Chukchi Seas Planning Areas would be indirectly affected by an impact to subsistence harvests. Drilling, infrastructure emplacement, pipeline trenching, and structural removal are unlikely to affect subsistence harvests nearshore in the Atlantic and Gulf of Mexico Program Areas, as well as the Cook Inlet Program Area, due to the distance from shore in the Atlantic and industry history and presence in the Gulf of Mexico and Cook Inlet. Refer to Section 4.4.1.17 of the Programmatic EIS.
Infrastructure Emplacement (other than noise)		
Pipeline Trenching		Any new pipelines to shore in the Gulf of Mexico would be analyzed further in a site specific NEPA document for this region. In the Alaska Program Areas, pipeline trenching would affect the benthic zone and therefore could indirectly affect vulnerable communities onshore via direct impacts in subsistence harvests nearshore. This would be further analyzed in a site specific NEPA document. Mitigation measures for walrus food sources (e.g., bivalves) and other subsistence species would be required. Refer to Section 4.4.1.17 of the Programmatic EIS.
Onshore Construction (other than noise)	Negligible – Minor (Gulf of Mexico) Minor (Cook Inlet) Minor – Moderate (Atlantic, Beaufort and Chukchi Seas)	While onshore activity is outside BOEM jurisdiction, it is assumed that state and local officials will adhere to local planning laws and ordinances. Refer to Section 4.4.1.17 of the Programmatic EIS.
Structure Removal (other than noise)	Negligible (Gulf of Mexico and Atlantic) Minor (Cook Inlet) Moderate – Major (Beaufort and Chukchi Seas)	
Air Emissions		
Onshore	Moderate	Refer to Section 4.4.1.17 of the Programmatic EIS.
Offshore	Minor	Offshore air emissions would be regulated by the most recent rulemakings. In the Atlantic, communities relying solely on subsistence harvests would be unlikely to travel past the 50-mile buffer. In the Gulf of Mexico, communities relying solely on subsistence harvests have done so, in tandem with the offshore oil industry since 1947. In the Alaska Program Areas, offshore air emissions would be analyzed further in a site specific NEPA document. Impacts to vulnerable communities in these areas are expected to be minor.

Impact-Producing Factor	Impact Determination for the Proposed Action	Explanation
Lighting		
Onshore Facilities	Minor – Moderate	While onshore activity is outside BOEM jurisdiction, it is assumed that state and local officials will adhere to local planning laws and ordinances. Given the existing support system for oil and gas related industry and its associated labor force, the effects are expected to be widely distributed, and is unlikely to significantly increase the already existing infrastructure in the Gulf of Mexico and Cook Inlet. Impacts to vulnerable communities in these areas are expected to be minor. In the Beaufort Sea, Chukchi Sea, and Atlantic Program Areas, there is little industry infrastructure and activity, as compared to the Gulf of Mexico (Section 4.3.1.13 of the Programmatic EIS). Lighting from onshore facilities has little potential to affect vulnerable communities in these areas, depending on its proximity to a given community. From late April to mid-August (when most activity would be taking place in open water), the Beaufort and Chukchi Seas will experience upwards of 17 hours of daylight, per 24 hours. Therefore, in these areas, it is anticipated that lighting would have a negligible impact on these communities. Refer to Section 4.4.1.17 of the Programmatic EIS.
Offshore Facilities	Negligible	In the Atlantic, communities relying solely on subsistence harvests would be unlikely to travel past the 50-mile buffer. In the Gulf of Mexico, communities relying solely on subsistence harvests have done so, in tandem with the offshore oil industry since 1947. In the Alaska Program Areas, it is unlikely that lighting from offshore facilities would cause disproportionate negative impacts to vulnerable households within a community onshore. Coastal villages adjacent to the Beaufort and Chukchi Seas Planning Areas are unlikely to be affected by lighting offshore due to the fact that it will be daylight for 17+ hours in a 24 hour period, during the open water season. Further, this would be analyzed in more detail in a regional NEPA document. Impacts to vulnerable communities in these areas are expected to be negligible.
Visible Infrastructure		
Onshore	Negligible (Gulf of Mexico) Minor (Cook Inlet) Moderate (Atlantic, Beaufort, and Chukchi Seas)	While onshore activity is outside BOEM jurisdiction, it is assumed that state and local officials will adhere to local planning laws and ordinances. Refer to Section 4.4.1.17 of the Programmatic EIS.

Impact-Producing Factor	Impact Determination for the Proposed Action	Explanation
Offshore	Negligible (Gulf of Mexico and Atlantic) Minor (Cook Inlet) Moderate (Beaufort and Chukchi Seas)	Given the existing extensive and widespread support system for the OCS oil and gas related industry and its associated labor force the effects are expected to be widely distributed, and would not change the already existing infrastructure in the Gulf of Mexico. In the Atlantic, communities relying solely on subsistence harvests would be unlikely to travel past the 50-mile buffer. In the Cook Inlet Program Area, there is industry activity in state waters, closer to shore. It is unlikely that offshore activity would affect the existing viewshed of vulnerable communities. Refer to Section 4.4.1.17 of the Programmatic EIS.
Space Use Conflicts		
Onshore Facilities	Minor (Gulf of Mexico) Minor – Moderate (AK, Atlantic)	While onshore activity is outside BOEM jurisdiction, it is assumed that state and local officials adhere to local planning laws and ordinances. Given the existing extensive and widespread support system for the OCS oil and gas related industry and its associated labor force the effects are expected to be widely distributed, and would not change the already existing infrastructure in the Gulf of Mexico. Impacts to vulnerable communities in these areas are expected to be minor. Refer to Section 4.4.1.17 of the Programmatic EIS.
Offshore Facilities	Minor (Atlantic, Gulf of Mexico, Cook Inlet) Moderate – Major (Beaufort and Chukchi Seas)	In the Atlantic, communities relying solely on subsistence harvests would be unlikely to travel past the 50-mile buffer. In the Cook Inlet program area, there is industry activity in state waters, closer to shore. It is unlikely that offshore activity would affect subsistence activities of vulnerable communities in this area. In the Gulf of Mexico, communities relying solely on subsistence harvests have done so, in tandem with the offshore oil industry since 1947. Impacts to vulnerable communities in these areas are expected to be minor. Refer to Section 4.4.1.17 of the Programmatic EIS.
Non-Routine Events		
Accidental Spills	Minor – Major	Refer to Section 4.4.4 of the Programmatic EIS.
CDE		

AK = Alaska; BOEM = Bureau of Ocean Energy Management; CDE = Catastrophic Discharge Event; EIS = Environmental Impact Statement; NEPA = National Environmental Policy Act; OCS = Outer Continental Shelf.

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Appendix E

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Appendix F

List of Preparers

1 # PREPARERS

2 ## BOEM PREPARERS AND REVIEWERS

Name	Education/Expertise	Contribution
Ololade Ajilore	M.S., Environmental Science and Policy; 6 years of environmental related sciences and field work.	Project management support
Tamara Arzt	J.D./M.P.A., ESA, NEPA, MMPA and CZMA, Environmental Law and Policy; 17 years of experience working on a variety of national, state, and local environmental policy and legal issues.	Purpose and Need, Alternatives
Gene Augustine	M.S., Biology; 39 years of experience in environmental biology, natural resources planning, wetland regulatory management, environmental impact analysis, OCSLA, NEPA, CWA, ESA, MMPA, and MBTA.	Coastal and Estuarine Habitat
Bruce Baird	M.S. Biological Oceanography; 30 years of experience in Marine Biology, Coastal Ecology, and NEPA.	Coastal and Estuarine Habitat
Mark Belter	B.S., Biology; 7 years of experience working with fisheries, marine biology and habitat restoration.	Fishes and EFH
David Bigger	Ph.D., Biology; 19 years of experience in ecology, scientific research, NEPA, ESA, and MBTA.	Coastal and Estuarine Habitat
Jennifer Bosyk	B.S., Biology; M.E.M., Coastal Environmental Management; 10 years of experience in marine mammal and sea turtle conservation biology; impact assessment; and ocean policy.	Marine Mammals, Pelagic Communities
Mary Cody	B.A., 26 years of experience with seabird and marine mammal research, NRDA and Recovery monitoring, MMPA management and enforcement, NEPA, ESA consultation.	Birds, Marine Mammals, Alternatives and Landscape Mitigation Development
Kim Coffman	M.P.P., Government in the Private Economy (emphasis on Economic and Inter-disciplinary Analysis of Public Policy); 25 years of experience working on OCS/5-Year Program issues, 17 years of experience with socioeconomic models.	Socioeconomic
Sarah Peters Coffman	M.A. and B.A., Economics; 6 years of experience in economic analysis.	Economics, Socioeconomics
Jennifer Culbertson	B.S., M.A., Ph.D., Marine Biology; 18 years of experience in marine ecosystems and impacts associated with oil in the marine environment.	Water Quality, Quantification of Accidental Spills
Keely Hite	B.S., Environmental Science; 9 years of experience NEPA OCS Programs HQ Tribal G-2-G Coordinator, Sociocultural/Socioeconomic SME, BOEM EJ Lead.	Environmental Justice, Recreation and Tourism
Tim Holder	B.A., Economics; Master of Urban Planning; 25 years of experience in NEPA analysis on socioeconomic and sociocultural topics and related studies, 20 years of experience in Alaska. Work with stakeholders in Alaska, particularly Iñupiat on the Alaskan North Slope. Circumpolar Arctic science and policy.	Sociocultural

Name	Education/Expertise	Contribution
Mark Jensen	M.S., Economics; experience in NEPA and economic analysis.	Economics
Brian Jordan	B.A., Anthropology; M.S., Wood Science; Ph.D., Natural Science and Resource Management; 20 years of experience in various aspects of maritime archaeology and underwater cultural heritage management, 11 years of experience in historic preservation issues related to underwater cultural heritage.	Archaeological and Historic Resources, National Historic Preservation Act, and Marine Protected Areas
Stanley Labak	B.S. and M.S., Ocean Engineering; 30 years of experience in sonar system design, acoustic modeling and sea testing, 20 years of experience in acoustic and impact analysis for environmental compliance documents.	Acoustics, Impact Modeling, technical review
Jacob Levenson	B.S., Zoology/Marine Science; M.S., Criminal Justice; 15 years of experience in commercial/recreational fisheries in federal fisheries management at NMFS, as charter vessel captain, and conducting independent science.	Commercial and Recreational Fisheries, Marine Mammals, Mapping
Jill Lewandowski	M.S. and Ph.D., Environmental Science and Policy; 22 years of experience in protected species assessment.	Supervision, Alternatives, QA/QC
Robert Martinson	B.S., Biological Science M.S. Zoology, 36 years of experience working on NEPA, ESA, CWA, Aquatic Ecology, Wetlands, Estuarine Ecology, and Coastal Restoration.	Project Management, Coastal and Estuarine Habitat
Davie Nguyen	B.A., Social Ecology; M.E.M., Environmental Management; 5 years of experience in NEPA, ocean policy, waste management.	Land Use and Infrastructure
Doug Piatkowski	B.S., M.S., Marine Biology; 13 years of experience in marine ecosystems and preparing NEPA and protected species assessments.	Sea Turtles
John Primo	B.A., Anthropology; M.A., Applied Anthropology, Grad Certificate in Environmental Management; Ph.D., Anthropology (Ecological and Environmental focus), M.A., Applied Anthropology, Grad Certificate in Environmental Management; 17 years of experience studying human-environment relationships in marine and freshwater environments involving coastal issues, fisheries, communities, urbanization, subsistence as well as federal natural resource management/decision-making.	Tourism and Recreation (secondary contributor)
Katherine Segarra	B.S., Environmental Science; Ph.D., Marine Sciences; B.S., Environmental Science; experience in marine and coastal science and policy with a focus in biogeochemistry, carbon cycling, benthic habitats, wetlands, and climate change.	Marine Benthic Resources
Kristen Strellec	B.S. and M.S., Energy, Environmental, and Mineral Economics; 17 years of experience in socioeconomic analysis and modeling.	Socioeconomic

Name	Education/Expertise	Contribution
Poojan Tripathi	M.S., Plant and Soil Science; 11 years of experience as an interdisciplinary environmental science with expertise in hydrology, water quality, wetlands, and NEPA.	Purpose and Need, Alternatives, Contracting Officer's Representative
Geoffrey Wikel	M.S., Marine Science; MPP; 15 years of experience in coastal geomorphology and oceanography.	Supervision, Project Management, Scenario, QA/QC
Eric Wolvovsky	B.S., Meteorology; M.S., Geographic Information Systems. 4 years of air quality experience.	Air Quality, Climate Change, Mapping

Contractors

Name	Contribution
CSA Ocean Sciences Inc.	Water Quality, Marine Benthic Communities, Pelagic Communities, Marine Mammals and Sea Turtles, Fisheries and EFH, Areas of Special Concern, and Commercial and Recreational Fishing technical input and review, editing, document production
Southeastern Archaeological Research, Inc. (SEARCH)	Archaeological and Historic Resources technical input
ESS Group, Inc.	Coastal and Marine Birds, Coastal and Estuarine Habitats, Air Quality, and Energy Markets technical input and review
PCCI	Infrastructure and Land Use technical input and review
Isley Enterprises, LLC	Technical review, editing
Lincoln Walther Consulting, LLC	Socioeconomic technical input
UMIAQ	Socioeconomic technical input and review
Natalie Kraft	Technical review, editing
Sara Spence	Technical review

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Appendix G

Mitigation and Protective Measures

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All Bureau of Ocean Energy Management (BOEM) sale proposals include rules and regulations prescribing environmental controls to be imposed on lease operators. Lease stipulations, Outer Continental Shelf (OCS) regulations, and other measures provide a regulatory base for implementing environmental protection on leases issued as a result of a sale. The BOEM Environmental Studies Program and the analyses and monitoring of activities in a sale area provide information used in formulating the agency's regulatory control over the activities that occur during the life of the leases.

The Bureau of Safety and Environmental Enforcement (BSEE) has broad permitting and monitoring authority to ensure safe operations and environmental protection. Use of the best available and safest technologies during exploration, development, and production as well as the adopted stipulations are just a few of the measures designed to prevent environmental damage. BSEE also monitors operations after drilling has begun and carries out periodic inspections of facilities (in certain instances, in conjunction with other federal agencies such as the U.S. Environmental Protection Agency [USEPA]) to ensure safe and clean operations over the life of the leases.

The analyses in the Environmental Impact Statement (EIS) assume the implementation of all impact-reducing mechanisms required by statute or regulation. In addition, the impact analysis assumes that sale-specific stipulations that were commonly adopted in past lease sales are in effect. The following is a brief description of the sale-specific stipulations or other impact-reducing mechanisms assumed in the analysis of potential effects of the Proposed Action.

Because numerous individual mitigations can be applied to exploration and development activities in the Gulf of Mexico region, only common lease stipulations are described individually. Both the lease stipulations and other protective environmental measures issued through Information to Lessees (ITL) in Alaska are described. There are currently no ILTs provided for the Atlantic region since exploration and development activities would be new to this area; however, it is anticipated that stipulations and ITLs would be developed similar to existing measures implemented in the Gulf of Mexico. The primary resource for this information is the Notice to Lessees and Operators webpage on the BOEM website (USDOI, 2015).

1. GULF OF MEXICO REGION

1.1. LEASE STIPULATIONS

1.1.1. Topographic Features

This stipulation designates a "No Activity Zone" around several underwater topographic features commonly called "banks" whose crests may contain biological communities, including corals. The No Activity Zone is designed to protect the biota of these features from adverse effects of routine offshore oil and gas activities by preventing the emplacement of platforms or the anchoring of service vessels or mobile drilling units directly on the banks and requiring that drilling discharges be shunted in such a manner that they do not settle on the biota.

Refer to NTL No. 2009-G39 – Biologically-Sensitive Underwater Features and Areas. http://www.boem.gov/Regulations/Notices-To-Lessees/2009/09-G39.aspx.

1.1.2. Live Bottom (Pinnacle Trend)

This stipulation is intended to protect the Pinnacle Trend area and the associated live bottom areas from damage from oil and gas activities. For the purpose of this stipulation, "live bottom areas" are defined as seagrass communities; areas that contain biological assemblages consisting of sessile invertebrates such as sea fans, sea whips, hydroids, anemones, ascidians, sponges, bryozoans, or corals living upon and attached to naturally occurring hard or rocky formations with rough, broken, or smooth topography; or areas whose lithotope favors the accumulation of turtles, fishes, and other fauna. If the required live bottom survey report determines that the live bottom may be adversely impacted by the proposed activity, certain measures, such as relocation or monitoring, may be required.

Refer to NTL No. 2009-G39 – Biologically-Sensitive Underwater Features and Areas. http://www.boem.gov/Regulations/Notices-To-Lessees/2009/09-G39.aspx.

1.1.3. Live Bottom (Low Relief)

This stipulation is intended to protect live bottom areas not associated with bathymetric features on the seafloor. For the purpose of this stipulation, “live bottom areas” are defined as seagrass communities; areas that contain biological assemblages consisting of sessile invertebrates such as sea fans, sea whips, hydroids, anemones, ascidians, sponges, bryozoans, or corals living upon and attached to naturally occurring hard or rocky formations with rough, broken, or smooth topography; or areas whose lithotope favors the accumulation of turtles, fishes, and other fauna. If the required live bottom survey report determines that the live bottom may be adversely impacted by the proposed activity, certain measures, such as relocation or monitoring, may be required.

Refer to NTL No. 2009-G39 – Biologically-Sensitive Underwater Features and Areas. http://www.boem.gov/Regulations/Notices-To-Lessees/2009/09-G39.aspx.

1.1.4. Military Areas

This stipulation has three sections: hold harmless, electromagnetic emissions, and operational. The hold harmless section serves to protect the U.S. Government from liability in the event of an accident involving a lessee and military activities. The electromagnetic emissions section requires the lessee and its agents to reduce and curtail the use of equipment emitting electromagnetic energy in certain areas. This reduces the impact of offshore oil and gas activities on military communications and missile testing. The operational section requires prior notification of the military when offshore oil and gas activities are scheduled within a military use area to assist in scheduling activities and to prevent potential conflicts.

A second stipulation requires the evacuation, upon the receipt of a directive from the BSEE Regional Director, of all personnel from all structures on the lease and the shutting in and securing of all wells and other equipment, including pipelines, on the lease.

Additional stipulations are applied to leases in the Eastern Gulf of Mexico Planning Area only. In cooperation with the U.S. Air Force, “drilling windows” are established for 6-month periods during which time exploratory operations or workover operations may be conducted on leases. This time-sharing arrangement allows military operations to proceed in areas containing leases without being disrupted by oil and gas activities and without undue disturbance to the exploratory activity and workover operations.

Refer to:

- NTL No. 2014-G04 – Military and Water Test Areas. http://www.boem.gov/BOEM-NTL-No-2014-G04/.
- NTL No. 2001-G10 – Clarification of Eastern Gulf of Mexico Sale 181 Military Areas Stipulation. http://www.boem.gov/Regulations/Notices-To-Lessees/2001/01-g10.aspx.
- Joint NTL No. 2014-G01 – Drilling Windows, Eastern Planning Area, Gulf of Mexico. http://www.boem.gov/Joint-NTL-No-2014-G01/.
- NTL No. 2009-G26 – U.S. Air Force Communication Towers. http://www.boem.gov/Regulations/Notices-To-Lessees/2009/09-G26.aspx.

1.2. Other Mitigations Categories

1.2.1. Air Quality

This category includes mitigative measures and background information that apply to offshore exploration, development, and pipeline activities. It should be noted that NTL No. 2009-N11 is provided from the National Office and is applicable in all OCS regions, not just the Gulf of Mexico.

Refer to:

- NTL No. 2009-N11 – Air Quality Jurisdiction on the OCS. http://www.boem.gov/Regulations/Notices-To-Lessees/2009/09-N11.aspx.
- NTL. No. 2014-G01 – 2014 Gulfwide OCS Emissions Inventory (Western Gulf of Mexico). http://www.boem.gov/BOEM-NTL-No-2014-G01/.

1.2.2. Archaeology

There is a series of mitigative measures that address procedures for conducting archaeological surveys before bottom-disturbing activities can occur on a lease; operators must follow these procedures to avoid impacts on potential prehistoric and shipwreck sites.

Refer to:

- NTL No. 2005-G07 – Archaeological Resource Surveys and Reports. http://www.boem.gov/Regulations/Notices-To-Lessees/2005/05-G07.aspx.
- NTL No.2011-JOINT-G01 – Revisions to the List of OCS Lease Blocks Requiring Archaeological Resource Surveys and Reports. http://www.boem.gov/Regulations/Notices-To-Lessees/2011/2011-JOINT-G01-pdf.aspx.

1.2.3. Artificial Reefs

Mitigative measures exist to avoid impacts on artificial reef sites and permit areas as well as other seafloor structures and hazards.

Refer to:

- NTL No. 2008-G05 – Shallow Hazards Program. http://www.boem.gov/NTL-No-2008-G05/.

1.2.4. Chemosynthetic Communities

This category includes mitigative measures to avoid impacts to deepwater benthic communities (which includes chemosynthetic communities) in deepwater areas of the Gulf of Mexico.

Refer to:

- NTL No. 2009-G40 – Deepwater Benthic Communities. http://www.boem.gov/Regulations/Notices-To-Lessees/2009/09-G40.aspx.

1.2.5. Coastal Zone Management

This notice clarifies the policy regarding revising OCS plans when a lessee proposes to change approved anchor patterns or anchor areas, provides guidance for wells the lessee plans to side track, makes minor administrative changes, and includes a guidance document statement (providing some guidance on Coastal Zone Management [CZM] review).

Refer to:

- NTL No. 2009-G27 – Submitting Exploration Plans and Development Operations Coordination Documents. http://www.boem.gov/Regulations/Notices-To-Lessees/2009/09-G27.aspx.

1.2.6. Topographic Features, Live Bottoms, and the Flower Garden Banks

There are a series of mitigative measures to protect the health and stability of these benthic features. Refer to:

- NTL No. 2009-G39 – Biologically-Sensitive Underwater Features and Areas. http://www.boem.gov/Regulations/Notices-To-Lessees/2009/09-G39.aspx.

1.2.7. Miscellaneous Mitigative Measures

There are a number of additional mitigation measures that apply to oil spill preparedness, seismic surveys, protected species, essential fish habitat, hydrogen sulfide, and other issues. Refer to:

- JOINT-NTL No. 2012-G01 – Vessel Strike Avoidance and Injured/Dead Protected Species Reporting. http://www.boem.gov/2012-JOINT-G01/.
- JOINT-NTL No. 2012-G02 – Implementation of Seismic Survey Mitigation Measures and Protected Species Observer Program. http://www.boem.gov/2012-JOINT-G02/.
- NTL No. 2009-G31 – Hydrogen Sulfide. http://www.boem.gov/Regulations/Notices-To-Lessees/2009/09-G31.aspx.
- NTL No. 2009-G34 – Ancillary Activities. http://www.boem.gov/Regulations/Notices-To-Lessees/2009/09-G34.aspx.

2. ALASKA REGION

2.1. Lease Stipulations

2.1.1. Protection of Fisheries (Cook Inlet Planning Area)

This stipulation is designed to minimize spatial conflicts between OCS activities and commercial, sport, and subsistence fishing activities. Lease-related uses will be restricted, if determined necessary by the BOEM Alaska Regional Supervisor for Field Operations, to prevent unreasonable conflicts with fishing operations. The stipulation requires the lessee to review planned exploration and development activities (including plans for seismic surveys, drilling rig transportation, or other vessel traffic) with potentially affected fishing organizations, subsistence communities, and port authorities to prevent unreasonable fishing gear conflicts.
Refer to:

- Cook Inlet Planning Area – Final Environmental Impact Statement for Lease Sales 191 and 199, Volume 1 (Executive Summary and Sections I through VI), Section II.F.1.a. – Standard Stipulations, Stipulation No. 1 – Protection of Fisheries. http://www.boem.gov/About-BOEM/BOEM-Regions/Alaska-Region/Environment/Environmental-Analysis/CIsV1.aspx.

2.1.2. Orientation Program

This stipulation is designed to provide an increased understanding of, and appreciation for, local community values, customs, and lifestyles of Alaska Native communities. The required orientation program must be designed in sufficient detail to inform individuals working on OCS projects of specific types of environmental, social, and cultural concerns in the area.

The orientation program must provide information to industry employees on protected species, biological resources used for commercial and subsistence purposes, archaeological resources of the area and appropriate ways to protect them, and reducing industrial noise and disturbance effects on marine mammals and marine and coastal birds. The program also must include information about avoiding conflicts with subsistence activities.

Refer to:

- Cook Inlet Planning Area – Final Environmental Impact Statement for Lease Sales 191 and 199, Volume 1 (Executive Summary and Sections I through VI), Section II.F.1.c. – Standard Stipulations, Stipulation No. 3 – Orientation Program. http://www.boem.gov/About-BOEM/BOEM-Regions/Alaska-Region/Environment/Environmental-Analysis/CIsV1.aspx.

2.1.3. Protection of Biological Resources

This stipulation provides for identifying and protecting previously unknown important or unique biological populations or habitats that may occur in a lease area. If previously unknown sensitive biological resources are identified during the conduct of lease activities under an approved Plan of Exploration or Development and Production Plan, the lessee will be required to modify operations, if necessary, to minimize adverse impacts on those biological populations or habitats.

Refer to:

- Cook Inlet Planning Area – Final Environmental Impact Statement for Lease Sales 191 and 199, Volume 1 (Executive Summary and Sections I through VI), Section II.F.1.b. – Standard Stipulations, Stipulation No. 2 – Protection of Biological Resources. http://www.boem.gov/About-BOEM/BOEM-Regions/Alaska-Region/Environment/Environmental-Analysis/CIsV1.aspx.

2.1.4. Transportation of Hydrocarbons

This stipulation informs lessees that (1) BOEM reserves the right to require the placement of pipelines in certain designated management areas; (2) pipelines must be designed and constructed to withstand the hazardous conditions that may be encountered in the sale area; and (3) pipeline construction and associated activities must comply with regulations. This stipulation requires the use of pipelines if (1) pipeline rights-of-way can be determined and obtained; (2) laying such pipelines is technologically feasible and environmentally preferable; and (3) in the opinion of the lessor, pipelines can be laid without net social loss, taking into account any incremental costs of pipelines over alternative methods of transportation and any incremental benefits in the form of increased environmental protection or reduced multiple-use conflicts.

Refer to:

- Cook Inlet Planning Area – Final Environmental Impact Statement for Lease Sales 191 and 199, Volume 1 (Executive Summary and Sections I through VI), Section II.F.1.d. – Standard Stipulations, Stipulation No. 4 – Transportation of Hydrocarbons. http://www.boem.gov/About-BOEM/BOEM-Regions/Alaska-Region/Environment/Environmental-Analysis/CIsV1.aspx.

2.1.5. Industry Site-Specific Monitoring Program for Marine Mammal Subsistence Resources (Arctic Planning Areas)

This stipulation requires industry to conduct a site-specific monitoring program to determine when marine mammals are present in the vicinity of exploration operations, including ancillary seismic surveys, during periods of subsistence use. The monitoring program and review process required for Marine Mammal Protection Act (MMPA) authorization will satisfy the requirements of this stipulation. The monitoring plan must provide for reports on marine mammal sightings and the extent of observed behavioral effects because of lease activities. It also provides a formal mechanism for the oil and gas industry to coordinate logistics activities with the BOEM Bowhead Whale Aerial Survey Program. The stipulation provides for an opportunity for recognized co-management organizations to review and comment on the proposed monitoring plan before BOEM approval. The stipulation requires the lessee to fund an independent peer review of the proposed monitoring plan and the draft reports on the results of the monitoring program. No monitoring program will be required if the BOEM Alaska Regional Supervisor for Field Operations, in consultation with the appropriate agencies and co-management organizations, determines that a monitoring program is not necessary based on the size, timing, duration, and scope of the proposed operations.

Refer to:

- Chukchi Sea Planning Area, Oil and Gas Lease Sale 193 in the Chukchi Sea, Alaska, Appendix D, Guide to Lease Stipulations, D-2.1.4. Stipulation No. 4. Industry Site-Specific Monitoring Program for Marine Mammal Subsistence Resources. http://www.boem.gov/uploadedFiles/BOEM/About_BOEM/BOEM_Regions/Alaska_Region/Leasing_and_Plans/Leasing/Lease_Sales/Sale_193/LeaseSale_193_DraftSSEIS_Vol2.pdf.

2.1.6. Conflict Avoidance Mechanisms to Protect Subsistence Whaling and Other Marine Mammal Subsistence Activities (Arctic Planning Areas)

This stipulation is designed to reduce disturbance effects on Alaska Native subsistence practices from OCS oil and gas industry activities by requiring the industry to make reasonable efforts to conduct all aspects of their operations in a manner that recognizes Alaska Native subsistence requirements and avoids conflict with local subsistence harvest activities. The stipulation applies to both on-lease operations and to support activities, such as vessel and aircraft traffic. The stipulation also requires industry to consult with directly affected subsistence communities, the North Slope Borough, and the recognized co-management organizations to discuss possible siting and timing conflicts and to assure that exploration, development, and production activities do not result in unreasonable conflicts with subsistence whaling and other subsistence harvests. The stipulation also provides a mechanism to address unresolved conflicts between the oil and gas industry and subsistence activities.

Refer to:

- Chukchi Sea Planning Area, Oil and Gas Lease Sale 193 in the Chukchi Sea, Alaska, Appendix D, Guide to Lease Stipulations, D-2.1.5. Stipulation No. 5. Conflict Avoidance Mechanisms to Protect Subsistence Whaling and Other Marine Mammal Subsistence-Harvesting Activities. http://www.boem.gov/uploadedFiles/BOEM/About_BOEM/BOEM_Regions/Alaska_Region/Leasing_and_Plans/Leasing/Lease_Sales/Sale_193/LeaseSale_193_DraftSSEIS_Vol2.pdf.

2.1.7. Measures to Minimize Effects on Spectacled and Steller's Eiders During Exploration Activities (Arctic Planning Areas)

This stipulation is designed to minimize the likelihood that spectacled or Steller's eiders (*Polysticta stelleri)* will strike drilling structures or vessels. The stipulation requires specific lighting protocols for structures and vessels, a plan for recording and reporting bird strikes, and avoidance of specified blocks by OCS-related vessels engaged in exploration activities.

Refer to:

- Chukchi Sea Planning Area, Oil and Gas Lease Sale 193 in the Chukchi Sea, Alaska, Appendix D, Guide to Lease Stipulations, D-2.1.7. Stipulation No. 7. Measures to Minimize Effects to spectacled and Steller's eiders During Exploration Activities. http://www.boem.gov/uploadedFiles/BOEM/About_BOEM/BOEM_Regions/Alaska_Region/Leasing_and_Plans/Leasing/Lease_Sales/Sale_193/LeaseSale_193_DraftSSEIS_Vol2.pdf.

2.1.8. Archaeology

This notice includes a series of measures describing procedures for conducting archaeological surveys before bottom-disturbing activities can occur on a lease; operators must follow these procedures to avoid impacts on potential prehistoric and shipwreck sites.

Refer to:

- NTL No. 05-A03 – Archaeological Survey and Evaluation for Exploration and Development Activities. http://www.boem.gov/uploadedFiles/BOEM/Regulations/Notices_To_Lessees/2005/05-a03.pdf.

2.1.9. Shallow Hazards Surveys

These NTLs provide guidance for shallow hazards geophysical surveys, evaluations, and reporting procedures for the Alaskan OCS region. Potentially hazardous shallow conditions, features, or processes include seismicity, subsurface faults, fault scarps, shallow gas, steep-walled canyons and slopes, buried channels, current scour, migrating sedimentary bedforms, ice gouging, permafrost, gas hydrates, unstable soil conditions, pipelines, anchors, ordinance, shipwrecks, and other geological or man-made features.

Refer to:

- NTL No. 05-A01 – Shallow Hazards Survey and Evaluation for OCS Exploration and Development Drilling. http://www.boem.gov/Regulations/Notices-To-Lessees/2005/05-a01.aspx.
- NTL No. 05-A02 – Shallow Hazards Survey and Evaluation for Alaska OCS Pipeline Routes and Rights of Way. http://www.boem.gov/Regulations/Notices-To-Lessees/2005/05-a02.aspx.

2.1.10. Alaska-Wide Mitigation Measures (Not Formal NTLs)

A number of mitigation measures were identified for the Alaska Region in the Five-Year Program 2012-2017, Final Environmental Impact Statement. Each of these measures was considered and partially analyzed in the Program's Final EIS, with the direction that these measures "will be analyzed further and considered in greater detail at subsequent stages," specifically including the lease sale stage.

(1) Ecologically and culturally important areas.
(2) Important subsistence and biological areas.
(3) Creation of buffers around sensitive areas and resources.
(4) Protection of areas upstream and downstream of important ecological areas.
(5) Areas that will protect both bowhead whales and subsistence communities.
(6) Seasonal restrictions in subsistence areas.
(7) Restrictions during migratory, breeding, and birthing periods.
(8) Delay of leasing until adequate spill control and response available.

Refer to:

- Mitigation/Program Tracking Table – Alaska Wide Mitigation Measures from the Five- Year OCS Oil and Gas Leasing Program, 2012-2017. http://www.boem.gov/2014-BOEM-AMMT/.

2.1.11. Cook Inlet Planning Area Specific Mitigation Measures (Not Formal NTLs)

A number of mitigation measures were identified for the Cook Inlet Planning Area in the Five-Year Program 2012-2017, Final Environmental Impact Statement. Each of these measures was considered and partially analyzed in the program's Final EIS, with the direction that these measures "will be analyzed further and considered in greater detail at subsequent stages," specifically including the lease sale stage.

(1) Deference of northern portion of lease sale area because of uncertain risks to area beluga whale population (same as the No Action alternative in the NEPA process).
(2) Deference of blocks that may adversely affect natural and cultural resource values of National Park Service (NPS) units within area. Reduction of the program area at the Area Identification stage to reduce effects to parks, preserves, and refuges. Consider residual effects in the Lease Sale EIS.
(3) Deference of Beluga Whale Critical Habitat. Area Identification excluded most of the Critical Habitat. Consider residual in the Lease Sale EIS.
(4) Deference of Northern Sea Otter Critical Habitat. Area Identification excluded most of the Critical Habitat. Consider residual in Lease Sale EIS.
(5) Ensure that future lease sale submissions possess a sufficient measure of oil spill response capabilities.

Refer to:

- Mitigation/Program Tracking Table – Cook Inlet Planning Area Specific Mitigation Measures from the Five Year OCS Oil and Gas Leasing Program, 2012-2017. http://www.boem.gov/2014-BOEM-AMMT/.

3. ATLANTIC REGION

3.1. LEASE STIPULATIONS

There are currently no general NTLs specific to the Atlantic region. It is anticipated that those NTLs issued from the National Office would be relevant to the Atlantic region. In addition, where National office-issued notices are lacking, it is anticipated that NTLs would be developed for implementation that would be similar to existing NTLs from different regions. For example, all authorizations for shipboard surveys would include guidance for vessel strike avoidance. The guidance would be similar to Joint

BOEM/BSEE NTL 2012-G01 ("Vessel Strike Avoidance and Injured/Dead Protected Species Reporting") (USDOI, BOEM and BSEE, 2012), which incorporates and expands measures from the National Marine Fisheries Service (NMFS) "Vessel Strike Avoidance Measures and Reporting for Mariners" addressing protected species identification, vessel strike avoidance, and injured/dead protected species reporting.

4. INFORMATION TO LESSEE (ITL)

Several ITLs have been developed to notify lessees and operators about environmental, social, and cultural concerns. Past ITLs have provided lessees information or advisories on the following:

- Community participation in operations planning;
- Bird and marine mammal protection laws;
- Endangered, threatened, and candidate species and designated critical habitat under the Endangered Species Act (ESA);
- Consideration in oil spill response plans of river deltas of the Beaufort Sea coastal plain that have been identified by the U.S. Fish and Wildlife Service (USFWS) as special habitats for bird nesting, fish overwintering, or for other species' use;
- Possible prohibition of shore-based facilities in river deltas that have been identified as special habitats;
- Potential effects of seismic surveys on marine mammals and subsistence activities;
- Requirements on the availability of bowhead whales for subsistence whaling;
- The BOEM bowhead whale aerial monitoring program;
- The possibility that BOEM may limit or modify operations if they could result in significant effects on the availability of bowhead whales for subsistence use;
- Requirements for the protection of polar bears and to limit potential encounters and interactions between lease operations and polar bears;
- Requirements for archaeological and shallow geologic hazards reports in support of exploration and development (E&D) plans;
- Navigational safety;
- Requirements for air quality permits;
- Designated Class I air quality areas;
- Requirements for National Pollutant Discharge Elimination System (NPDES) permits for the discharge of produced water, drilling fluids, and cuttings;
- Sensitive areas to be considered when developing oil spill contingency plans;
- Requirements for BSEE approval of oil spill response plans;
- Requirements for establishing and maintaining oil spill financial responsibility;
- BOEM encouragement of the use of existing pads and islands wherever feasible;
- The importance of the area around Cross Island for Nuiqsut subsistence whaling activities;
- Requirements for mitigation of unreasonable conflicts with subsistence activities; and
- BOEM encouragement of the industry to establish a Good Neighbor Policy to provide an immediate compensation system to minimize disruption to subsistence activities and provide resources to relocate subsistence hunters to alternate hunting areas or provide temporary food supplies in the event that an accidental oil spill adversely affects the harvest of marine subsistence resources.

5. OTHER PROTECTIVE MEASURES APPLIED THROUGH LAWS AND REGULATIONS

BOEM also assumes in this Programmatic EIS, for analytical purposes only, other protective measures that are most commonly applied through laws and regulations. BOEM assumes OCS activities will occur in compliance with all laws and regulations and that other protective measures will be applied through those laws and regulations. Though not exhaustive, below is a list of those measures that are most applicable to the resource areas fully analyzed in this Programmatic EIS. For more information on the related laws and regulations, see **Appendix H**.

- National Ambient Air Quality Standards (NAAQS) as required by the Clean Air Act (CAA) and administered by the U.S. Environmental Protection Agency (USEPA).
- Prevention of Significant Deterioration (PSD) Program for air pollutant concentrations as administered by the USEPA.
- National Pollution Discharge Elimination System (NPDES) permitting as administered by the USEPA.
- Liability and compensation for oil spill-related damages as required by the Oil Pollution Act and administered by the U.S. Coast Guard (USCG).
- Endangered Species Act (ESA) and Marine Mammal Protection Act (MMPA) mitigation measures as applied through ESA and MMPA consultations with USFWS and NMFS aimed to ensure the protection of any endangered or threatened species, marine mammal, and their critical habitat. Examples of ESA/MMPA protective measures for OCS oil and gas activities are (but are not limited to):
    - — Pre-activity survey requirements,
    - — Activity ramp-up procedures,
    - — Marine mammal observers,
    - — Speed restrictions,
    - — Activity exclusion zones, and
    - — Incidental take authorizations.
- Archaeological survey and mitigation as required by the National Historic Preservation Act (NHPA), State Historic Preservation Offices, and BOEM and BSEE regulations.
- Fishery management plans as required by the Magnuson-Stevens Fishery Conservation and Management Act (FCMA).
- Essential Fish Habitat (EFH) designations and protections as required by FCMA and administered by NMFS.

6. LITERATURE CITED

U.S. Department of the Interior, Bureau of Ocean Energy Management. 2015. Notice to Lessees and Operators. Website: http://www.boem.gov/Notices-to-Lessees-and-Operators/. Accessed: 15 September 2015.

U.S. Department of the Interior, Bureau of Ocean Energy Management and Bureau of Safety and Environmental Enforcement. 2012. Notice to Lessees and Operators, Vessel Strike Avoidance and Injured/Dead Protected Species Reporting. Joint NTL No. 2012-G01. Website http://www.boem.gov/2012-JOINT-G01/. Accessed: 17 September 2015.

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Appendix H

Federal Laws and Executive Orders

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FEDERAL LAWS

1. NATIONAL ENVIRONMENTAL POLICY ACT

The National Environmental Policy Act (NEPA) of 1969 establishes a national environmental policy that "…encourages the productive and enjoyable harmony between man and his environment…" by requiring that all federal agencies conduct an environmental analysis of any proposed federal action that may have a significant impact upon the quality of the human environment. This environmental analysis occurs through the environmental impact assessment process that uses a systematic, interdisciplinary approach which seeks to balance protecting the quality of the human environment with the impacts of the proposed federal action.

In 1979, the Council on Environmental Quality (CEQ) established uniform guidelines for implementing the procedural provisions of NEPA. Regulations 40 CFR parts 1500 through 1508 provide for the use of the NEPA process to identify and assess reasonable alternatives to a Proposed Action that avoid or mitigate adverse effects of that action upon the quality of the human environment. The United States Department of the Interior (USDOI) regulations to implement NEPA are in 43 CFR part 46 (73 FR 61292).

An Environmental Assessment (EA) is prepared to determine whether significant impacts to the human environment may occur. If an EA finds that significant impacts may occur, NEPA requires a detailed Environmental Impact Statement (EIS) be prepared. The EIS shall discuss significant environmental impacts fully and inform decision-makers and the public of reasonable alternatives. In addition, the EIS must address any adverse environmental effects that cannot be avoided or mitigated, alternatives to the Proposed Action, the relationship between short-term uses and long-term productivity of the environment, and any irreversible and irretrievable commitments of resources involved in the Proposed Action. The NEPA requirement for analysis of major federal actions is the underlying driver for the production of this Programmatic EIS. The briefest form of NEPA review is the categorical exclusion (CATEX) review. A CATEX review verifies that neither an EA nor an EIS is needed prior to making a decision on the activity being considered for approval.

The USDOI Implementation of NEPA Final Rule (43 CFR part 46) establishes procedures for the Department and its constituent bureaus to use for compliance with NEPA and the CEQ regulations for implementing NEPA. The Final Rule supplements, and is to be used in conjunction with, the CEQ regulations except where it is inconsistent with other statutory requirements.

The USDOI has a number of implementing guidelines that provide agency direction in the application of NEPA. These include USDOI Departmental Manual Part 516, Chapter 15, which outlines the basic guidelines for implementing NEPA. It delineates NEPA responsibilities within the USDOI, provides guidance to applicants, defines major actions normally requiring an EIS, and identifies actions that have been designated as CATEXs.

The USDOI Environmental Memoranda Series addresses the Department's environmental responsibilities in three areas: compliance, review, and statement. The Environmental Compliance Memoranda Series provides guidance to bureaus and agencies of the USDOI to ensure compliance with pollution control and environmental protection statutes. The Environmental Review Memoranda Series furnishes information and guidance concerning the receipt, distribution, coordination, and conduct of environmental project reviews requested by other agencies. The Environmental Statement Memoranda Series provides complementary information and guidance to bureaus and offices of the USDOI to ensure compliance with NEPA. NEPA compliance follows this order of precedence: (1) CEQ regulations, (2) USDOI regulations (43 CFR part 46), (3) USDOI policy (Departmental Manual Part 516), and (4) USDOI guidance provided in the Environmental Memoranda Series.

2. OUTER CONTINENTAL SHELF LANDS ACT

The Outer Continental Shelf Lands Act (OCSLA) of 1953 (43 U.S.C. 1331 *et seq.*), as amended, establishes federal jurisdiction over submerged lands on the Outer Continental Shelf (OCS) seaward of state boundaries, which were defined in the Submerged Lands Act of 1953. OCSLA provides guidelines for implementing an OCS oil and gas exploration and development program. Basic goals of OCSLA include the following:

(1) Establish policies and procedures for managing the oil and natural gas resources of the OCS that are intended to result in expedited exploration and development in order to achieve national economic and energy policy goals, assure national security, reduce dependence on foreign sources, and maintain a favorable balance of payments in world trade;
(2) Preserve, protect, and develop oil and natural gas resources of the OCS in a manner that is consistent with the need to (a) make such resources available to meet the nation's energy needs as rapidly as possible; (b) balance orderly resource development with protection of the human, marine, and coastal environments; (c) ensure the public a fair and equitable return on the resources of the OCS; and (d) preserve and maintain free enterprise competition;
(3) Encourage development of new and improved technology for energy resource production, which will eliminate or minimize risk of damage to the human, marine, and coastal environments; and
(4) Ensure that affected states and local governments have timely access to information regarding OCS activities and opportunities to review, comment, and participate in policy and planning decisions.

The Secretary of the Interior is responsible under OCSLA for the administration of mineral exploration and development of the OCS. Within the USDOI, the Bureau of Ocean Energy Management (BOEM) is charged with managing and regulating the development of OCS oil and gas resources in accordance with the provisions of OCSLA. BOEM operating regulations are listed under 30 CFR part 550 for oil and gas and 30 CFR part 585 for renewable energy. Regulations shared between BOEM and the Bureau of Safety and Environmental Enforcement (BSEE) are listed under 30 CFR parts 251 and 254.

The Energy Policy Act of 2005 amended Section 8 of OCSLA to authorize the USDOI to grant leases, easements, or rights-of-way on the OCS for the development and support of energy resources from sources other than oil and gas and allow for alternate uses of existing facilities on the OCS. Under OCSLA, BOEM also has jurisdiction over certain geophysical surveying (i.e., seismic, side-scan sonar, bathymetric, and magnetometer surveys, etc.) and geological sampling activities (i.e., vibracoring, boring, grab sampling, etc.) that occur in support of the exploration and development of energy and mineral resources on the OCS. BOEM has no jurisdiction over these activities in state waters.

Section 11(a)(1) of OCSLA states, "[A]ny agency of the United States and any person authorized by the Secretary may conduct geological and geophysical explorations in the outer Continental Shelf, which do not interfere with or endanger actual operations under any lease maintained or granted pursuant to this Act, and which are not unduly harmful to aquatic life in such area." Section 11(g) specifies that permits for geological explorations shall be issued only if the Secretary of the Interior determines that "such exploration will not be unduly harmful to aquatic life in the area…."

Section 20 of the OCSLA states the Secretary of the Interior shall "...conduct such additional studies to establish environmental information as he deems necessary and shall monitor the human, marine, and coastal environments of such area or region in a manner designed to provide time-series and data trend information which can be used for comparison with any previously collected data for the purpose of identifying any significant changes in the quality and productivity of such environments, for establishing trends in the area studied and monitored, and for designing experiments to identify the causes of such changes."

3. ENDANGERED SPECIES ACT

The Endangered Species Act (ESA), enacted in 1973 (16 U.S.C. 1531), provides for conservation of threatened and endangered plants and animals, and the ecosystems on which they depend. The ESA was designed to protect and recover critically imperiled species as a "consequence of economic growth and development untempered by adequate concern and conservation" and is administered by the United States Fish and Wildlife Service (USFWS) and the National Marine Fisheries Service (NMFS). NMFS has jurisdiction over marine species (except polar bears, walruses, sea otters, and manatees), while the USFWS has responsibility over freshwater fishes and all other species. Species occurring in both habitats (e.g., sea turtles and certain fishes) are jointly managed.

Section 7(a)(1) of the ESA directs agencies to utilize their authorities to carry out programs for the conservation of threatened and endangered species. Federal agencies must consult with NMFS and the USFWS, under Section 7(a)(2), on activities that may affect a listed species. Interagency, or Section 7, consultations are designed to assist federal agencies in fulfilling their duty to ensure federal actions do not jeopardize the continued existence of a species or destroy, or adversely modify, critical habitat.

Under Section 7, to initiate consultation, a federal agency submits a consultation package, usually referred to as a biological assessment (BA), to the USFWS or NMFS for Proposed Actions that may affect listed species or critical habitat. If a listed species or critical habitat is likely to be affected by a proposed federal action, the federal agency must provide the USFWS and NMFS with an evaluation describing whether the effect on the listed species or critical habitat is likely to be adverse. After NMFS and the USFWS review the BA, they provide a determination regarding the nature of any effects on each listed species or critical habitat. For each species likely to be adversely affected (i.e., subject to take, or via adverse effect on critical habitat), formal consultation is required, ending with the agency issuing a Biological Opinion (BO) containing the necessary and sufficient terms and conditions under which the action can proceed. Informal consultation is required for species not likely to be adversely affected and concludes with agency concurrence with the findings, including any additional measures mutually agreed upon as necessary and sufficient to minimize adverse impacts to listed species and/or designated critical habitat. Additionally, the ESA defines the "take" of a listed species as harassing, harming, pursuing, hunting, shooting, wounding, killing, trapping, capturing, collecting, or attempting to do these things. Federal agencies may be allowed a limited take of species through interagency consultations with NMFS or the USFWS and by issuance of an incidental take statement (ITS) included with the biological opinion.

4. MARINE MAMMAL PROTECTION ACT

The Marine Mammal Protection Act (MMPA) was enacted on October 21, 1972 based on the following findings: marine mammals are resources of great international significance; certain species or stocks are, or may be, in danger of extinction or depletion as a result of man's activities; such species or stocks should not be permitted to diminish beyond the point at which they cease to be a significant functioning element in the ecosystem of which they are a part; and the primary objective of their management should be to maintain the health and stability of the marine ecosystem. This statement clearly speaks to the need to maintain a broad scope that considers species- and ecosystem-level impacts. To serve this broader goal, the MMPA (16 U.S.C. 1371, 50 CFR part 1) established a moratorium on the take of marine mammals, with certain exceptions. One of these is the issuance of incidental take authorizations (ITAs). The marine mammal non-fishery interaction program is tasked with implementation of Section 101(a)(5)(A-D) of the MMPA, as amended (16 U.S.C. 1371(a)(5)), which provides a mechanism for allowing, upon request, the "incidental" but not intentional taking of small numbers of marine mammals by U.S. citizens who engage in a specified activity other than commercial fishing within a specified geographic region.

The term "take," as defined in the MMPA, means to harass, hunt, capture, or kill any marine mammal or to attempt such activity. The MMPA defines harassment as any act of pursuit, torment, or annoyance that has the potential to injure a marine mammal or marine mammal stock in the wild (termed Level A harassment) or disturb a marine mammal or marine mammal stock in the wild by causing disruption of behavioral patterns, including migration, breathing, nursing, breeding, feeding, or sheltering (termed Level B harassment).

In 1981, Congress amended the MMPA to provide for ITAs for maritime activities, provided NMFS found that the takes would be limited to small numbers, would have no more than a "negligible impact" on the marine mammal species not listed as depleted under the MMPA (i.e., listed under the ESA), and would not have an "unmitigable adverse impact" on subsistence harvests of these species. These ITAs, or letters of authorization (LOAs), require that regulations be promulgated and published in the *Federal Register* outlining the following:

- Permissible methods and the specified geographical region of take;
- The means of effecting the least practicable adverse impact on the species or stock and its habitat, and on the availability of the species or stock for "subsistence" uses; and
- Requirements for monitoring and reporting, including requirements for the independent peer-review of monitoring plans where the proposed activity may affect the availability of a species or stock for taking for subsistence uses.

In 1986, Congress amended the MMPA, under the incidental take program, and the ESA, to authorize takings of depleted (and endangered or threatened) marine mammals, again provided the taking (lethal, injurious, or harassment) was small in number and had a negligible impact on marine mammal stocks. Therefore, upon request of a U.S. citizen conducting a specified activity, NMFS must make a decision as to whether such request for authorization of take incidental to that activity be authorized or denied. In order to authorize such take, NMFS must describe required mitigation and monitoring and provide bounds on the numbers of incidental takes allowed in order to ensure that an applicant, in the course of conducting a proposed activity, does not have more than a negligible impact on the affected species or stocks of marine mammals. As directed by Congress, this is necessary to ensure that marine mammal species or stocks do not diminish beyond the point at which they cease to be a significant functioning element in the ecosystem of which they are a part.

In 1994, MMPA Section 101(a)(5) was amended to establish an expedited process through which U.S. citizens can apply for an authorization to incidentally take small numbers of marine mammals by harassment, referred to as incidental harassment authorizations (IHAs). It established specific time limits for public notice and comment on any requests for authorization that would be granted under this new provision. Because the IHA process has eliminated the need for promulgating specific regulations on incidental take, IHAs have been of increasing interest since 1994 for individuals with relatively short-term activities that might inadvertently harass marine mammals.

5. COASTAL ZONE MANAGEMENT ACT

The Coastal Zone Management Act (CZMA) of 1972 (16 U.S.C. 1451 *et seq.*) was enacted to develop a national coastal management program that comprehensively manages and balances competing uses of and impacts to any coastal use or resource. The National Coastal Management Program is implemented by individual state coastal management programs in partnership with the Federal Government. The CZMA federal consistency regulations require that federal activities (e.g., OCS lease sales) be consistent to the extent practicable with the enforceable policies of a state's coastal management program. Federal consistency regulations also require that other federally-approved activities (e.g., activities requiring federal permits such as activities described in OCS plans) be fully consistent with the enforceable policies of a state's federally approved coastal management program. The CZMA is administered by the Office of Ocean and Coastal Resource Management within the National Ocean Service (NOS). The NOS implementing regulations are found at 15 CFR part 930, with the latest revision published in 71 FR 788.

The overall program objectives of the CZMA are to "preserve, protect, develop, and where possible, to restore or enhance the resources of the nation's coastal zone." The 34 coastal states each have programs to address the balance in competing land and water issues in the coastal zone. A state's jurisdictional purview typically extends 3 nautical miles (nmi) (5.6 km) offshore of the coast and coastal islands (Texas, the Gulf coast of Florida, and Louisiana are the exceptions). Texas and the Gulf coast of Florida are extended 9 nmi (16.7 km) seaward, and Louisiana is extended 3 imperial nautical miles (1 imperial nautical mile = 6,080.2 ft). Federal actions within these areas are evaluated under NEPA and are subject to additional state regulations when federal sovereign immunity has been waived by Congress.

The CZMA and implementing regulations require agency actions that are reasonably foreseeable to affect any land or water use, or natural resource of the coastal zone, to be consistent with enforceable policies of the states' coastal management program. Accordingly, BOEM is to provide the states with information on lease sales and exploration and development plans for review during a designated period to conduct a consistency determination, a review to determine if the proposed activities are consistent with the states' coastal management policies. If a coastal state determines that a Proposed Action by BOEM is not consistent with the state's approved coastal zone management program, it can pursue one of a number of administrative remedies.

6. MAGNUSON-STEVENS FISHERY CONSERVATION AND MANAGEMENT ACT

The Magnuson-Stevens Fishery Conservation and Management Act (FCMA) (P.L. 94-265) was enacted to address impacts to fisheries on the U.S. Continental Shelf. It established U.S. fishery management over fishes within the fishery conservation zone from the seaward boundary of the coastal states out to 200 nmi (370 km) (i.e., the boundary of the U.S. Exclusive Economic Zone [EEZ]). The FCMA also established regulations for foreign fishing within the fishery conservation zone and issued national standards for fishery conservation and management to be applied by eight regional fishery management councils. Each council is responsible for developing Fishery Management Plans (FMPs) for domestic fisheries within its geographic jurisdiction. In 1996, Congress enacted amendments to the FCMA known as the Sustainable Fisheries Act (SFA) (P.L. 104-297) to address substantially reduced fish stocks resulting from direct and indirect habitat loss.

The SFA requires that BOEM and other agencies consult with NMFS concerning actions that may adversely impact essential fish habitat (EFH). EFH is defined as the waters and substrate necessary to fishes or invertebrates for spawning, breeding, feeding, or growth to maturity. Areas designated as EFH contain habitat essential to the long-term survival and health of U.S. fisheries. EFHs for managed fisheries are described in the FMPs.

Federal agencies that authorize, fund, or undertake actions that might adversely affect EFH must consult with the Secretary of Commerce, through NMFS, regarding potential effects to EFH. To streamline the process, NMFS combines EFH consultations with existing environmental reviews required by other laws such as NEPA, and as a result most consultations are completed within the time frames for review of other documents.

7. CLEAN AIR ACT

OCSLA (43 U.S.C. 1334[a][8]) requires the Secretary of the Interior to promulgate and administer regulations that comply with the National Ambient Air Quality Standards (NAAQS) pursuant to the Clean Air Act (CAA) (42 U.S.C. 7401 *et seq.*) and to the extent that authorized activities significantly affect the air quality of any state. Under provisions of the Clean Air Act, as amended, the U.S. Environmental Protection Agency (USEPA) Administrator, in consultation with the Secretary of the Interior and the Commandant of the United States Coast Guard (USCG), established requirements to control air pollution in OCS areas of the Arctic, Atlantic, Pacific, and parts of the GOM.

OCS sources within 25 nmi (46.3 km) of the states' seaward boundaries are subject to the same federal and state requirements as sources located onshore. OCS sources beyond 25 nmi (46.3 km) of the states' boundaries are subject to federal requirements for Prevention of Significant Deterioration (PSD) promulgated pursuant to Part C of Title 1 of the CAA, as amended. The CAA, as amended, also established procedures to allow the USEPA Administrator to exempt any OCS source from a control technology requirement if it is technically infeasible or poses an unreasonable threat to health, safety, security, and environment (HSSE).

BOEM air quality regulations (30 CFR part 250 subpart C) assess and control OCS emissions that may impact air quality onshore. BOEM applies defined criteria to determine which OCS plans require an air quality review and performs an impact-based analysis on the selected plans to determine whether the emission source could cause a significant onshore impact. Regulated pollutants include carbon monoxide, particulates, sulfur dioxide, nitrogen oxides, and volatile organic compounds (VOCs). If an emission source is determined to be significant and therefore requires air quality modeling, the USEPA-preferred model, the Steady-state Gaussian, Offshore and Coastal Dispersion (OCD) Model, should be used.

Because the review under this document is programmatic in nature and does not address project-specific information regarding air quality issues, it will not result in a permit application under the CAA.

8. CLEAN WATER ACT

The Clean Water Act (CWA) (33 U.S.C. §1251 *et seq.*) established the basic structure for regulating discharges of pollutants into U.S. waters and regulating quality standards for surface waters. The basis of the CWA, enacted in 1948, was the Federal Water Pollution Control Act (FWPCA), which established water pollution control activities to restore and maintain the chemical, physical and biological integrity of the nation's waters. When the FWPCA was significantly reorganized and expanded with amendments in 1972, the common name became the Clean Water Act. Under the CWA, it is unlawful for any person to discharge any pollutant from a point source into navigable waters without a National Pollutant Discharge Elimination System (NPDES) permit. All waste streams generated from offshore oil and gas activities are regulated by the USEPA, primarily by general permits. The USEPA may not issue a permit for a discharge into ocean waters unless the discharge complies with the guidelines established under Section 403(c) of the CWA. These guidelines are intended to prevent degradation of the marine environment and require an assessment of the effect of the proposed discharges on sensitive biological communities and aesthetic, recreational, and economic values.

Other sections of the CWA also apply to offshore activities. Section 404 requires a United States Army Corps of Engineers (USACE) permit for the discharge or deposition of dredged or fill material in all U.S. waters, including ocean areas and estuaries. Approval by the USACE, with consultation from other federal and state agencies, is required for installing and maintaining pipelines and OCS seafloor structures in coastal areas. Section 303 of the CWA provides for the establishment of water quality standards that identify a designated use for waters (e.g., fishing/swimming). States have adopted water quality standards for ocean waters within their jurisdiction (waters of the territorial sea extending out to 3 nmi [5.6 km]). Operators would be required to obtain an NPDES permit from the USEPA for any effluent discharges including drilling fluids and cuttings from a continental offshore strategic test (COST) or shallow test well.

The USACE's Nationwide Permit (NWP) Program, also called a general permit (USACE, 2012), was developed to streamline the evaluation and approval process for certain types of activities that have minimal impacts to the aquatic environment. Any applicant that intends to use an NWP must ensure that their proposed activity meets the terms, conditions, and regional conditions of the NWP as well as any additional coastal zone management program or Section 401 water quality requirements.

NWP 6 addresses survey activities such as core sampling, seismic exploratory operations, plugging of seismic shot holes and other exploratory-type bore holes, exploratory trenching, soil surveys, sampling, and historic resource surveys. Most geological and geophysical (G&G) survey activities would require an

NWP 6. Drilling and discharge of excavated material from test wells for oil and gas exploration are not authorized by NWP 6 and would require a Section 404/Section 10 permit, also called a standard permit.

Because the review under this document is programmatic in nature and does not address project-specific information regarding water quality issues, it will not result in a permit application under the CWA.

9. RIVERS AND HARBORS ACT

The Rivers and Harbors Act (RHA) (33 U.S.C. 401, 403, 407), enacted in 1899, was the first federal water pollution act in the U.S. It focuses on protecting navigation and waters from pollution, and acted as a precursor to the CWA of 1972. Section 10 (33 U.S.C. 403) prohibits the unauthorized obstruction or alteration of any navigable water of the U.S. (i.e., construction of various structures that hinder navigable capacity of any waters) without the approval of Congress. While the initial purpose of the RHA was to prevent obstructions to navigation, a 1959 Supreme Court decision interpreted obstruction to navigation to include water pollution. The Supreme Court found anything that tends to destroy the navigable capacity of a navigable waterway is prohibited by the RHA.

Operators planning to install structures for the exploration, production, and transportation of oil, gas, and minerals on the OCS must apply for a Section 10 Permit. The USACE can authorize these activities by a standard individual permit, letter-of-permission, general permit, NWP, or regional permit, and makes this determination at the time of application. Typically, the USACE authorizes the installation of these OCS structures under NWP 8. Under an NWP 8, such structures shall not be placed (1) within the limits of any designated shipping safety fairway or traffic separation scheme, except temporary anchors that comply with the fairway regulations in 33 CFR 322.5(l), (2) within established danger zones or restricted areas as designated in 33 CFR Part 334, or (3) within USEPA- or USACE-designated dredged material disposal areas.

10. NATIONAL HISTORIC PRESERVATION ACT

The National Historic Preservation Act (NHPA) of 1966, as amended (16 U.S.C. § 470), established a program for the preservation of historic properties. Section 106 of the NHPA (36 CFR part 800), "Protection of Historic Properties," as amended through 2004, requires federal agencies that have direct or indirect jurisdiction over a proposed federal, federally-assisted, or federally-licensed undertaking to take into account the effect of the undertaking on any district, site, building, structure, or object included in or eligible for inclusion in the *National Register of Historic Places* prior to approval of the expenditure of funds or the issuance of a license. The Advisory Council on Historic Preservation (ACHP), which administers Section 106, has issued regulations (36 CFR part 800) defining how federal agencies are to meet the statutory responsibilities. The head of a federal agency shall afford the ACHP a reasonable opportunity to review and comment on the action.

An action has an effect on a historic property when that action alters the characteristics of the property that led to its inclusion in the *National Register of Historic Places*. Effects can include physical disturbance, noise, or visual effects. If an adverse effect on historic properties is found, BOEM notifies the ACHP, consults with the State Historic Preservation Office, and encourages the applicant to avoid, minimize, or mitigate the adverse effects. Ground-disturbing activities associated with construction as well as visual effects of OCS energy infrastructure (e.g., platforms) are subject to Section 106 review.

Historic properties (i.e., archaeological resources) on the OCS include historic shipwrecks, sunken aircraft, lighthouses, and prehistoric archaeological sites that have become inundated as a result of the 120-m (394-ft) rise in global sea level since the height of the last Ice Age (approximately 19,000 years ago). The OCS is not federally owned land, and the Federal Government has not claimed direct ownership of historic properties on the OCS; therefore, under Section 106 of the NHPA, BOEM only has the authority to ensure that their funded and permitted actions do not adversely affect significant historic properties. Prior to approving any OCS exploration or development activities within an archaeological sensitive area, BOEM requires the lessee to conduct a marine remote sensing survey to prepare an archaeological report. Beyond avoidance of adverse impacts, BOEM does not have the legal authority to manage historic properties on the OCS.

11. Marine Protection, Research, and Sanctuaries Act

The Marine Protection, Research, and Sanctuaries Act (MPRSA) (33 U.S.C. § 1401 *et seq.*), enacted in 1972 and also referred to as the Ocean Dumping Act, generally prohibits (1) transportation of material from the U.S. for the purpose of ocean dumping; (2) transportation of material from anywhere for the purpose of ocean dumping by U.S. agencies or U.S.-flagged vessels; and (3) dumping of material transported from outside the U.S. into the U.S. territorial sea. Material includes, but is not limited to, dredged material; solid waste; incinerator residue; garbage; sewage; sewage sludge; munitions; chemical and biological warfare agents; radioactive materials; chemicals; biological and laboratory waste; wrecked or discarded equipment; rocks; sand; excavation debris; and industrial, municipal, agricultural, and other waste. The term does not include sewage from vessels or oil, unless the oil is transported via a vessel or aircraft for the purpose of dumping. Disposal by means of a pipe, regardless of how far at sea the discharge occurs, is regulated by the CWA through the NPDES permit process. A permit is required to deviate from these prohibitions.

Under the MPRSA, the standard for permit issuance is whether the dumping will “unreasonably degrade or endanger” human health, welfare, or the marine environment. The USEPA is charged with developing ocean dumping criteria to be used in evaluating permit applications. The MPRSA provides for a research program on ocean dumping and contains provisions that address marine sanctuaries, which are administered by the National Oceanographic and Atmospheric Administration (NOAA).

Because the review under this document is programmatic in nature and does not address project-specific information regarding potential impacts to sanctuaries, it will not result in a permit application under the MPRSA.

12. National Marine Sanctuaries Act

The National Marine Sanctuaries Act (NMSA) (16 U.S.C. § 1431 *et seq.*) was enacted in 1972 and is the legislative mandate that governs Office of National Marine Sanctuaries (ONMS) and the National Marine Sanctuary (NMS) System. Under the NMSA, the Secretary of Commerce is authorized to designate and manage areas of the marine environment as NMSs. Such designation is based on attributes of special national significance, including conservation, recreational, ecological, historical, scientific, cultural, archaeological, educational, or aesthetic qualities. Day-to-day management of NMSs has been delegated by the Secretary of Commerce to the ONMS.

The primary mandate of the NMSA is resource protection. The NMSA provides several tools for protecting designated NMSs, including the authority to issue regulations for each sanctuary and the system as a whole. The ONMS regulations, codified at 15 CFR part 922, prohibit specific kinds of activities, describe and define the boundaries of the NMSs, and set up a system of permits to allow the conduct of certain types of activities. Permits are required for any action that includes activities otherwise prohibited by sanctuary regulations. More information regarding ONMS permits can be found on NOAA’s ONMS website.

Section 304(d) of the NMSA requires that federal agencies consult with the ONMS for any federal action internal or external to an NMS that is “likely to destroy, cause the loss of, or injure a sanctuary resource.” The purpose of the consultation is to prevent or to minimize potential injury to any NMS resource by requiring assessment of the proposed federal action before the initiation of any such action and allowing the ONMS opportunity to recommend alternatives that would protect sanctuary resources. To streamline the sanctuary consultation process, the ONMS may combine the process with environmental reviews required by other laws such as NEPA.

Because the review under this document is programmatic in nature and does not address project-specific information regarding potential impacts to NMSs, it will not result in site-specific permit applications and review under ONMS regulations at this time.

13. MIGRATORY BIRD TREATY ACT

The Migratory Bird Treaty Act (MBTA) of 1918 (16 U.S.C. 703-712) is the primary legislation in the U.S. for the conservation of migratory birds. It implements the U.S.'s commitment to four bilateral treaties, or conventions, for the protection of a shared migratory bird resource. The MBTA prohibits the taking, killing, or possession of migratory birds and the nests or eggs of any such bird unless permitted by regulation. Bird species protected by the MBTA appear in 75 FR 9282. Executive Order (EO) 13186, Responsibilities of Federal Agencies to Protect Migratory Birds, signed on January 10, 2001 (66 FR 3853), requires that federal agencies taking actions likely to affect migratory bird populations negatively enter into memorandums of understanding (MOUs) with the USFWS.

On June 4, 2009, BOEM entered into an MOU with the USFWS to comply with EO 13186 (USDOI, 2009). The overall purpose of the MOU is to strengthen collaboration between BOEM, BSEE, and the USFWS. Included in the MOU is the direction to expand coverage in NEPA environmental reviews of the effects of agency actions on migratory birds, with emphasis on species of concern in furtherance of conservation of migratory bird populations and their habitats.

Because the review under this document is programmatic in nature and does not address project-specific information regarding impacts to migratory birds, it will not result in a permit application under the MBTA.

14. FISH AND WILDLIFE COORDINATION ACT

The Fish and Wildlife Coordination Act (FWCA) (16 U.S.C. §§ 661-666c), enacted March 10, 1934, is intended to protect fish and wildlife when federal actions result in the control or modification of a natural stream or body of water. The FWCA provides the basic authority for the involvement of the USFWS in evaluating impacts to fish and wildlife from proposed water resource development projects. The FWCA requires that all federal agencies consult with the USFWS, NMFS, and state wildlife agencies for activities that affect, control, or modify waters of any stream or bodies of water. NEPA was originally proposed as an amendment to the FWCA, but ultimately was enacted as an independent directive.

15. THE ENERGY POLICY ACT OF 2005

The Energy Policy Act, enacted in 2005, gives BOEM new responsibilities over federal offshore renewable energy and related uses of the OCS. Section 388 gives the Secretary of the Interior the authority to grant leases, easements, or rights-of-way for renewable energy-related uses on the federal OCS, and to monitor and regulate the facilities used for energy production and energy support services.

16. THE ALASKA NATIONAL INTEREST LANDS CONSERVATION ACT

In 1980, the Alaska National Interest Lands Conservation Act (ANILCA) created over 40 million ha (100 million ac) of new national parks, refuges, monuments, conservation areas, recreation areas, forests, and wild and scenic rivers in the State of Alaska for the preservation of "nationally significant" natural resources. To address special issues and needs arising from the new land designations, ANILCA contains numerous provisions and special rules for managing Alaska's public lands and nationally important resource development potential. ANILCA requires federal land managers to balance the national interest in Alaska's scenic and wildlife resources with recognition of Alaska's economy and infrastructure, and its distinctive rural way of life. Title VIII of ANILCA requires that subsistence uses by "rural" Alaska residents be given a priority over all other uses of fish and game, including sport and commercial uses, on federal public lands in Alaska. As a compromise, Congress allowed the State to continue managing fish and game uses on federal public lands, but only on the condition that the State of Alaska adopt a statute that made the new Title VIII "rural" subsistence priority applicable on state, as well as on federal lands. If the State ever falls out of compliance with Title VIII, Congress requires the Secretary of the Interior to reassume management of fish and game on Alaska's federal public lands. Section 810 of ANILCA creates special steps a federal agency must take before it decides to "withdraw, reserve, lease, or otherwise permit the use, occupancy, or disposition of public land."

Specifically, the federal agency must first evaluate three factors: the effect of its action on subsistence uses and needs; the availability of other lands for the purposes sought to be achieved; and alternatives that would "reduce or eliminate the use, occupancy, or disposition of public lands needed for subsistence purposes." If the federal agency were to conclude that its action "would significantly restrict subsistence uses," it must notify the appropriate state agency, regional council, and local committee. It then must hold a hearing in the vicinity of the area involved, and must make the following findings:

- Such significant restriction of subsistence uses is necessary and consistent with sound management principles for the utilization of public lands;
- The proposed activity will involve the minimal amount of public lands necessary to accomplish the purpose of such use, occupancy, or other disposition; and
- Reasonable steps will be taken to minimize adverse impacts upon subsistence uses and resources resulting from such actions (16 USC 3120(a)(3)).

In Amoco Production v. Village of Gambell, 480 U.S. 531 (1987), the U.S. Supreme Court ruled that ANILCA applies only to federal lands within the State of Alaska's boundaries. The Act defines "public lands" to mean federal lands situated "in Alaska," which the Court ruled to mean within the territorial boundaries of the State, which ends in coastal waters to a point 5.6 km (3 nmi) from the coastline. Therefore, the OCS is not encompassed by the words "in Alaska" and pipelines on the OCS are not subject to ANILCA. However, the sections of these pipelines that eventually enter into state waters are subject to ANILCA.

17. The International Convention of the Prevention of Pollution from Ships and Marine Plastic Pollution Research and Control Act

In 1978, the International Convention of the Prevention of Pollution from Ships (MARPOL) was updated to include five annexes on ocean dumping. By signing MARPOL, countries agree to enforce Annexes I and II (oil and noxious liquid substances) of the treaty. Annexes III (hazardous substances), IV (sewage), and V (plastics) are optional. The United States is signatory to two of the optional MARPOL Annexes, III and V. Annex V is of particular importance to the maritime community including shippers, oil platform personnel, fishers, and recreational boaters because it prohibits the disposal of plastic at sea and regulates the disposal of other types of garbage at sea. The USCG is the enforcement agency for MARPOL Annex V within the U.S. EEZ, within 370 km (200 nmi) of the U.S. shore.

The Marine Plastic Pollution Research and Control Act (MPPRCA) is the federal law implementing MARPOL Annex V in all U.S. waters. Under the MPPRCA, it is illegal to throw plastic trash off any vessel within the EEZ. It is also illegal to throw any other garbage (e.g., orange peels, paper plates, glass jars, and monofilament fishing line) overboard while navigating in inland waters or within 5 km (3 mi) offshore. The greater the distance from shore, the fewer restrictions apply to nonplastic garbage. However, dumping plastics overboard in any waters anywhere is illegal at any time. Fixed and floating platforms, drilling rigs, manned production platforms, and support vessels operating under a federal oil and gas lease are required to develop waste management plans and post placards reflecting discharge limitations and restrictions. Garbage must be brought ashore and properly disposed of in a trash can, dumpster, or recycling container. Docks and marinas are required to provide facilities to handle normal amounts of garbage from their paying customers. Violations of MARPOL or MPPRCA may result in a fine of up to $50,000 for each incident. If criminal intent can be proven, an individual may be fined up to $250,000 and/or imprisoned up to 6 year. If an organization is responsible, it may be fined up to $500,000 and/or be subject to 6 year of imprisonment of the responsible party.

18. THE MERCHANT MARINE ACT OF 1920 (JONES ACT)

The Merchant Marine Act of 1920, or Jones Act, regulates coastal shipping between ports and inland waterways. The Jones Act provides that "no merchandise shall be transported by water, or by land and water …between points in the United States… in any other vessel than a vessel built in and documented under the laws of the United States and owned by persons who are citizens of the United States…" Therefore, the Jones Act requires that all goods shipped between different ports in the United States or its territories must be:

- Carried on vessels built and documented (flagged) in the United States;
- Crewed by U.S. citizens or legal aliens licensed by the USCG; and
- Owned and operated by U.S. citizens.

The rationale behind the Jones Act and earlier sabotage laws was that the United States needed a merchant marine fleet to ensure that its domestic waterborne commerce remained under government jurisdiction for regulatory, safety, and national defense considerations. The same general principles of safety regulations are applied to other modes of transportation in the United States. While other modes of transportation can operate foreign-built equipment, these units must comply with U.S. standards. However, many foreign-built ships do not meet the standards required of U.S.-built ships and, thus, are excluded from domestic shipping.

The U.S. Customs Service has determined that facilities fixed or attached to the OCS used for the purpose of oil exploration are considered points within the United States. OCS oil facilities are considered U.S. sovereign territory and fall under the requirements of the Jones Act, so all shipping to and from these facilities related to OCS oil exploration can only be conducted by vessels meeting the requirements of the Jones Act. Shuttle tankering of oil that is produced at OCS facilities can only be legally provided by U.S.-registered vessels and aircraft that are properly endorsed for coastwise trade under the laws of the United States.

19. THE NATIONAL FISHING ENHANCEMENT ACT

The National Fishing Enhancement Act of 1984, also known as the Artificial Reef Act, established broad artificial-reef development standards and a national policy to encourage the development of artificial reefs that will enhance fishery resources, and commercial and recreational fishing. The national plan identifies oil and gas structures as acceptable material of opportunity for artificial-reef development. The Minerals Management Service (MMS), now BSEE, adopted a rigs-to-reefs policy in 1985 in response to the Artificial Reef Act, and to broaden interest in the use of petroleum platforms as artificial reefs.

20. THE OIL POLLUTION ACT

The Oil Pollution Act (OPA 90) establishes a single uniform federal system of liability and compensation for damages caused by oil spills in U.S. navigable waters. The OPA 90 requires removal of spilled oil and establishes a national system of planning for, and responding to, oil-spill incidents. In addition, OPA 90 includes provisions to do the following:

- Improve oil-spill prevention, preparedness, and response capability;

- Establish limitations on liability for damages resulting from oil pollution;
- Promote funding for natural resource damage assessment;
- Implement a fund for the payment of compensation for such damages; and
- Establish an oil pollution research and development program.

The USCG is responsible for enforcing vessel compliance with the OPA 90. The Secretary of the Interior is given authority over offshore facilities and associated pipelines (except deepwater ports) for all federal and state waters, including responsibility for spill prevention, oil-spill contingency plans, oil-spill containment and cleanup equipment, financial responsibility certification, and civil penalties. The Secretary of the Interior delegated this authority to BOEM and BSEE.

BOEM regulations governing oil-spill financial responsibility (OSFR) for offshore facilities and related requirements for certain crude oil wells, production platforms, and pipelines located in the OCS and certain state waters became effective in October 1998. These regulations implement the OPA requirement for responsible parties to demonstrate they can pay for cleanup and damages caused by facility oil spills. Responsible parties can be required to demonstrate as much as $150 million in OSFR if BOEM determines that it is justified by the risks of potential oil spills from the covered offshore facilities. The minimum amount of OSFR that must be demonstrated is $35 million for covered offshore facilities located in the OCS, and $10 million for covered offshore facilities located in state waters. The regulation exempts persons responsible for facilities having a potential worst-case, oil-spill discharge of <1,000 barrels (bbl), unless the risks posed by a facility justify a lower threshold.

21. THE OUTER CONTINENTAL SHELF DEEP WATER ROYALTY RELIEF ACT

The Outer Continental Shelf Deep Water Royalty Relief Act of 1995 directs the Secretary of the Interior to suspend royalties on existing leases in certain deep water areas of the Gulf of Mexico OCS when a specific set of conditions are met. Upon receipt of a complete application, the Secretary of the Interior is to determine whether proposed new production would be economic while subject to the requirement to pay federal royalties. The DWRRA directs the Secretary of the Interior to consider in the determination the increased risk of operating in deep water and costs associated with exploring, developing and producing. Lessees are required to submit a complete application which provides the necessary raw and interpreted data on the field so that such a determination can be made.

There are two economic hurdles that a field must clear to be eligible for a royalty suspension. If, after reviewing the application, the Secretary of the Interior determines that the new production would be economic while paying federal royalties, then royalty obligations will not be suspended. Further, a determination that no amount of royalty-free production would make the new production economically viable also disqualifies the field from a royalty suspension. Alternatively, if the field would not be economic while paying federal royalties but some amount of royalty-free production would make the new production economically viable, the field would qualify for at least the minimum suspension volume. Should production from a field not be economic with a royalty suspension volume equal to the mandated minimum, the Secretary of the Interior must determine the precise volume of royalty-free production which would make the production economic.

A two-part evaluation process has been devised to direct royalty relief to fields that appear uneconomic with royalties, but that are potentially viable with royalty suspensions. The first part of the process is conducted by the royalty relief applicant and the second part is performed by BOEM.

22. THE PORTS AND WATERWAYS SAFETY ACT

The Ports and Waterways Safety Act authorizes the USCG to designate safety fairways, fairway anchorages, and traffic separation schemes to provide unobstructed approaches through oil fields for vessels using ports. The USCG regulations provide listings of these designated areas along with special conditions related to oil and gas production. In general, no fixed structures such as platforms are allowed in fairways. Temporary underwater obstacles such as anchors and attendant cables or chains attached to floating or semisubmersible drilling rigs may be placed in a fairway under certain conditions. Fixed structures may be placed in anchorages, but the number of structures is limited.

23. THE RESOURCE CONSERVATION AND RECOVERY ACT

The Resource Conservation and Recovery Act (RCRA) provides a framework for the safe disposal and management of hazardous and solid wastes. Most oil-field wastes have been exempted from coverage under RCRA hazardous waste regulations. Any hazardous wastes generated on the OCS that are not exempt must be transported to shore for disposal at a hazardous waste facility.

EXECUTIVE ORDERS

1. EXECUTIVE ORDER 12114: ENVIRONMENTAL EFFECTS ABROAD OF MAJOR FEDERAL ACTIONS

Issued by President Carter on January 4, 1979, EO 12114 directs federal agencies to provide for informed decision-making for major federal actions with effects that occur outside the 50 states, territories, and possessions of the U.S., including marine waters seaward of U.S. territorial seas, the global commons, the environment of a nonparticipating foreign nation, or effects to protected global resources. Global commons are defined as "geographical areas that are outside of the jurisdiction of any nation, and include the oceans outside territorial limits and Antarctica. Global commons do not include contiguous zones and fisheries zones of foreign nations" (32 CFR § 187.3).

An Overseas EIS is required when an action has the potential to significantly harm the environment of the global commons. The procedural requirements under EO 12114 largely mirror those of NEPA, except EO 12114 does not require scoping.

2. EXECUTIVE ORDER 12898: FEDERAL ACTIONS TO ADDRESS ENVIRONMENTAL JUSTICE IN MINORITY POPULATIONS AND LOW-INCOME POPULATIONS

Signed by President Clinton on February 11, 1994, EO 12898 required that each federal agency, to the extent practicable and permitted by law, make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations. The EO required that within one year each federal agency develop an environmental justice strategy that identified and addressed disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority and low-income populations. The CEQ has oversight of the Federal Government's compliance with EO 12898. CEQ (1997) guidance for implementation of EO 12898 in the context of NEPA identifies a minority population as an affected area where >50 percent of the population belongs to a minority group or where the percentage presence of minority groups is meaningfully greater than in the general population.

Potential environmental justice communities have been identified in this Programmatic EIS (see **Appendix C**). Future environmental reviews of site-specific projects would be expected to identify individual low-income communities, such as fishing communities, and to assess any disproportionate human health and environmental effects that these communities could face.

3. EXECUTIVE ORDER 13089: CORAL REEF PROTECTION ACT

EO 13089 was signed by President Clinton on June 11, 1998, to preserve and protect the coral reef ecosystems of the U.S. This EO acts in furtherance of the CWA, CZMA, MSFCMA, NEPA, and NMSA.

All federal agencies whose actions may affect U.S. coral reef ecosystems shall: (1) identify their actions that may affect U.S. coral reef ecosystems; (2) utilize their programs and authorities to protect and enhance the conditions of such ecosystems; and (3) to the extent permitted by law, ensure that any actions they authorize, fund, or carry out will not degrade the conditions of such ecosystems (63 FR 32701). The Secretary of the Interior serves as a co-chair for the U.S. Coral Reef Task Force. The USDOI also works with domestic and international partners through the Coral Reef Initiative. This initiative focuses efforts to protect and monitor coral reefs around the world by building and sustaining partnerships, programs, and institutional capacities at the local, national, regional, and international levels.

4. Executive Order 13158: Marine Protected Areas

Signed by President Clinton on May 26, 2000, EO 13158 strengthened and expanded the nation's system of marine protected areas (MPAs) (65 FR 34909). Specifically, consistent with domestic and international law, the EO: (1) strengthens the management, protection, and conservation of existing MPAs and establishes new or expanded MPAs; (2) develops a scientifically based, comprehensive national system of MPAs representing diverse U.S. marine ecosystems as well as the nation's natural and cultural resources; and (3) avoids causing harm to MPAs through federally conducted, approved, or funded activities. The South Atlantic Fishery Management Council (SAFMC, 2011b) defines MPAs within its jurisdiction as a network of specific areas of marine environments reserved and managed for the primary purpose of aiding in the recovery of overfished stocks and ensuring the persistence of healthy fish stocks, fisheries, and associated habitats. Such areas may include naturally–occurring, artificial bottom, or water column habitats, and harvest on seasonal or permanent time periods may be prohibited to achieve desired fishery conservation and management goals.

5. Executive Order 13175: Consultation and Coordination with Indian Tribal Governments

Signed by President Clinton on November 6, 2000, EO 13175 established regular and meaningful consultation and collaboration with tribal officials in the development of federal policies that have tribal implications, to strengthen the U.S. government-to-government relationships with Indian Tribes and reduce the imposition of unfunded mandates upon Indian Tribes. EO 13175 reaffirmed the Federal Government's commitment to a government-to-government relationship with Indian Tribes and directed federal agencies to establish procedures to consult and collaborate with tribal governments when new agency regulations would have tribal implications. This EO is a directive to all federal agencies, but it only has persuasive authority for independent regulatory agencies (e.g., the Federal Communications Commission, Securities and Exchange Commission, etc.), and is not meant to create a substantial or procedural right that is enforceable by law.

6. Executive Order 13547: Stewardship of the Ocean, Our Coasts, and the Great Lakes

Signed by President Obama on July 19, 2010, EO 13547 established a national ocean policy and the National Ocean Council (75 FR 43023). The EO established a national policy to ensure the protection, maintenance, and restoration of the health of ocean, coastal, and Great Lakes ecosystems and resources; enhance the sustainability of ocean and coastal economies; preserve our maritime heritage; support sustainable uses and access; provide for adaptive management to enhance our understanding of and capacity to respond to climate change and ocean acidification; and coordinate with U.S. national security and foreign policy interests. Where BOEM actions affect the ocean, the EO requires BOEM to take such action as necessary to implement this policy, the stewardship principles, national priority objectives adopted by the EO, and guidance from the National Ocean Council.

Implementation of the guidelines presented in EO 13547 is still in the planning stages at BOEM and will occur in a three-stage process that will culminate with a final Coastal and Marine Spatial Planning (CMSP) process.

7. EXECUTIVE ORDER 13007: INDIAN SACRED SITES (MAY 1996)

The Indian Sacred Sites EO directs federal land-managing agencies to accommodate access to, and ceremonial use of, Indian sacred sites by Indian religious practitioners, and avoid adversely affecting the physical integrity of such sacred sites. It is BOEM's policy to consider the potential effects of all aspects of plans, projects, programs, and activities on Indian sacred sites, and consult, to the greatest extent practicable and to the extent permitted by law, with tribal governments before taking actions that may affect Indian sacred sites located on federal lands.

8. EXECUTIVE ORDER 13112: INVASIVE SPECIES (FEBRUARY 1999)

The EO defines an "invasive species" as a species that is nonnative, or alien, to the ecosystem under consideration and whose introduction causes, or is likely to cause, economic or environmental harm or harm to human health. This EO requires all federal agencies to do as follows:

- Identify any actions affecting the status of invasive species;
- Prevent introduction of invasive species;
- Detect, respond to, and control populations of invasive species in a cost-effective and environmentally sound manner;
- Monitor invasive species populations accurately and reliably;
- Provide for restoration of native species and habitat conditions in invaded ecosystems;
- Conduct research on invasive species, and develop technologies to prevent their introduction, and provide for environmentally sound control of invasive species;
- Promote public education on invasive species and the means to address them; and
- Refrain from authorizing, funding, or carrying out actions that are likely to cause or promote the introduction or spread of invasive species, unless the agency has determined that the benefits of such actions clearly outweigh the potential harm caused by invasive species, and that all feasible and prudent measures to minimize risk of harm will be taken.

In addition, the EO established the National Invasive Species Council, co-chaired by the Secretaries of Agriculture, Commerce and the Interior, and further comprising the Secretaries of State, Treasury, Defense, and Transportation, and the Administrator of the USEPA. The Council does the following:

- Provides national leadership on invasive species;
- Sees that federal efforts are coordinated and effective;
- Promotes action at local, state, tribal and ecosystem levels;
- Identifies recommendations for international cooperation;
- Facilitates a coordinated network to document and monitor invasive species;
- Develops a web-based information network;
- Provides guidance on invasive species for federal agencies to use in implementing the NEPA; and
- Prepares an Invasive Species Management Plan to serve as the blueprint for federal action to prevent introduction, provide control, and minimize economic, environmental, and human health impacts of invasive species.

BOEM requires that EISs prepared for major federal OCS actions (e.g., the 5-Year OCS Leasing Program, and OCS lease sales) contain an assessment of the Proposed Action's contribution to the invasive species problem.

9. Executive Order 11988, Floodplain Management (May 24, 1977), Amended by EO 12148 (July 20, 1979)

EO 11988 requires federal agencies to avoid to the extent possible the long- and short-term adverse impacts associated with the occupancy and modification of floodplains, and direct and indirect support of floodplain development wherever there is a practicable alternative. In accomplishing this objective, "each agency shall provide leadership and shall take action to reduce the risk of flood loss, to minimize the impact of floods on human safety, health, and welfare, and to restore and preserve the natural and beneficial values served by flood plains in carrying out its responsibilities" for the following actions:

- Acquiring, managing, and disposing of federal lands and facilities;
- Providing federally undertaken, financed, or assisted construction and improvements; and
- Conducting federal activities and programs affecting land use, including but not limited to water and related land resources planning, regulation, and licensing activities.

The EO outlines an eight-step process that federal agencies should carry out as part of their decision-making process regarding projects that may have potential impacts to, or within, a floodplain. In summary:

(1) Determine if a Proposed Action is in the base floodplain (that area which has a one percent or greater chance of flooding in any given year);
(2) Conduct early public review, including public notice;
(3) Identify and evaluate practicable alternatives to locating in the base floodplain, including alternative sites outside of the floodplain;
(4) Identify impacts of the Proposed Action;
(5) If impacts cannot be avoided, develop measures to minimize the impacts and restore and preserve the floodplain, as appropriate;
(6) Reevaluate alternatives;
(7) Present the findings and a public explanation; and
(8) Implement the action.

10. Executive Order 11990: Wetlands Protection (May 24, 1977), Amended by EO 12608 (September 9, 1987)

The purpose of EO 11990 is to "minimize the destruction, loss or degradation of wetlands and to preserve and enhance the natural and beneficial values of wetlands." To meet these objectives, the order requires federal agencies, in planning their actions, to consider alternatives to wetland sites and limit potential damage if an activity affecting a wetland cannot be avoided. The order applies to the following federal actions:

- Acquisition, management, and disposition of federal lands and facilities;
- Federally undertaken, financed, or assisted construction and improvements;
- Improvement projects which are undertaken, financed, or assisted by federal agencies; and

- Federal activities and programs affecting land use, including but not limited to water and related land resources planning, regulation, and licensing activities.

The EO outlines a similar eight-step process as that required in EO 11988 for floodplain management. Federal agencies should carry out that process as part of their decision-making on projects that have potential impacts to, or within, wetlands.

11. EXECUTIVE ORDER 13186: RESPONSIBILITIES OF FEDERAL AGENCIES TO PROTECT MIGRATORY BIRDS (JANUARY 10, 2001)

EO 13186 directs executive departments and federal agencies to take certain actions to further implement the MBTA. Any executive department or federal agency taking actions that have, or are likely to have, a measurable negative effect on migratory bird populations is directed to develop and implement an MOU with the USFWS that shall promote the conservation of migratory bird populations.