OCS EIS/EA
BOEM 2016-060

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

Final
Programmatic Environmental Impact Statement

November 2016

Volume II: Appendices A – J

U.S. Department of the Interior
Bureau of Ocean Energy Management
www.boem.gov

BOEM
BUREAU OF OCEAN ENERGY MANAGEMENT

This page intentionally left blank

LIST OF APPENDICES

This page intentionally left blank

Appendix A

Glossary

This page intentionally left blank

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).

cancellation – A lease sale cancellation occurs when the Secretary of the Interior cancels an OCS lease sale with no rescheduling.

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.

Congressional Moratorium (Moratorium) - Congress passes legislation signed into law by the President that removes areas from leasing consideration for a time period.

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.

deferral – The Secretary of the Interior delays a lease sale to later in a Program.

delineation well – an exploratory well drilled to define the areal extent of a field.

development – activities that take place following discovery of minerals in paying quantities, including geophysical activity, drilling, platform construction, and operation of all shorebase 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 the development and production plan are wholly identified in 30 CFR 550.

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 could 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 could 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 550) 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 –the unintentional emission of an air pollutant from an emissions source that does not 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.

ice keel – The submerged counterpart of an ice ridge or the submerged, downward-projecting part, or underside structure, of ice sheets or floes that have collided and formed pressure ridges.

ice lead – a narrow, linear crack in sea ice that forms when ice floes diverge or shear as the ice floes move parallel to each other.

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.

oil spill response vessel – a vessel or barge that is designed to recover or mitigate spilled oil and are typically equipped with containment booms, mechanical recovery devices, pumps, and onboard storage

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 – an administrative subdivision of an OCS 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 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.

Presidential withdrawal (withdrawal) - Under OCSLA, the President can withdraw areas from OCS leasing consideration for an indefinite time period.

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.

spring lead – a large fracture within an expanse of sea ice, defining a linear area of open water; the spring lead system is the combination of numerous and dynamic leads in the sea ice used as habitat by numerous species of birds and marine mammals

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.

This page intentionally left blank

Appendix B

Ongoing and Reasonably Foreseeable Future Actions

This page intentionally left blank

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

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-Alaska 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)

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

Type of Action or Trend	Associated Activities, Facilities, or Processes	Impact-Producing Factors	Affected Resources and Systems
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 – Arctic (Continued)

Type of Action or Trend	Associated Activities, Facilities, or Processes	Impact-Producing Factors	Affected Resources and Systems
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 Geotechnical and geohazard surveys Exploratory drilling Marine vessel traffic Offshore drilling vessels Production Other oil and gas activities in Beaufort Sea	Same as for ongoing activities onshore and in state waters (if developed)	Same as for ongoing activities onshore and in state waters (if developed)
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 (Arctic and circum-Arctic)	Cargo vessels Tugs and barges Service vessels Oil spill response 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 – Arctic (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 and NASA operations	Aircraft traffic Marine vessel traffic (submarines and icebreakers) Sounding rocket launches	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) Entanglement in or ingestion of debris by marine wildlife Disturbance or injury of fish and wildlife	Air quality, water quality, acoustic environment, marine and coastal habitats, and marine and coastal fauna (fish, marine mammals, and birds), tourism and recreation, and sociocultural systems (subsistence harvesting)

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

Type of Action or Trend	Associated Activities, Facilities, or Processes	Impact-Producing Factors	Affected Resources and Systems
Climate change	Increase in atmospheric temperatures Change 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. Cook Inlet Ongoing and Reasonably Foreseeable Future Actions

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 Geotechnical and geohazard 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 – 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 – 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 Oil spill response vessels 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 – 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	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 – 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)
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)

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

Type of Action or Trend	Associated Activities, Facilities, or Processes	Impact-Producing Factors	Affected Resources and Systems
Climate change	Increase in atmospheric and ocean temperatures Change 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. Gulf of Mexico Ongoing and Reasonably Foreseeable Future Actions

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 –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 –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 Oil spill response vessels 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 –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 –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 Change 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

This page intentionally left blank

Appendix C

SUPPORTING INFORMATION FOR THE AFFECTED ENVIRONMENT (CHAPTER 4)

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ACRONYMS AND ABBREVIATIONS

$\mu g\ L^{-1}$	micrograms per liter
ADF&G	Alaska Department of Fish and Game
AFB	Air Force Base
AHTS	anchor handling towing supply
bbl	barrels of oil
BIA	Biologically Important Area
BLM	Bureau of Land Management
BOEM	Bureau of Ocean Energy Management
B.P.	before present
bpd	barrel per day
BSEE	Bureau of Safety and Environmental Enforcement
CAA	Clean Air Act
CAH	Central Arctic Herd
CDE	catastrophic discharge event
CEQ	Council on Environmental Quality
CO	carbon monoxide
CV	coefficient variation
CWA	Clean Water Act
DPS	Distinct Population Segment
EEZ	Exclusive Economic Zone
EFH	Essential Fish Habitat
Eh	oxidation reduction potential
EIS	Environmental Impact Statement
E.O.	Executive Order
ESA	Endangered Species Act
FAA	Federal Aviation Administration
FLM	Federal Land Manager
FMC	Fisheries Management Council
FMP	Fisheries Management Plan
FR	*Federal Register*
ft	feet
ft^2	square feet
FWC	Fish and Wildlife Commission
G&G	geological and geophysical
GDP	Gross Domestic Product
GMFMC	Gulf of Mexico Fishery Management Council
GOA	Gulf of Alaska
GOAFMP	Gulf of Alaska Fisheries Management Plan
GOM	Gulf of Mexico
HAPC	Habitat Area of Particular Concern
IBA	Important Bird Area
JBER	Joint Base Elmendorf-Richardson
km	kilometer
KPB	Kenai Peninsula Borough
LCI	Lower Cook Inlet
LNG	liquefied natural gas
LRRS	long-range radar site
m	meter
m^2	square meters
Mat-Su	Matanuska-Susitna Borough
MBTA	Migratory Bird Treaty Act
$Mg\ L^{-1}$	Milligrams per liter
mi	mile
MMPA	Marine Mammal Protection Act
MoA	Municipality of Anchorage
MPA	Marine Protected Areas
MPRSA	Marine Protection, Research, and Sanctuaries Act
NAAQS	National Ambient Air Quality Standards
National Register	National Register of Historic Places
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NIC	National Incident Command

nmi	nautical mile
NMFS	National Marine Fisheries Service
NMS	National Marine Sanctuary
NO_2	nitrous dioxide
NPDES	National Pollution Discharge Elimination System
NPFMC	North Pacific Fishery Management Council
NPR-A	National Petroleum Reserve - Alaska
NPS	National Park Service
NWR	National Wildlife Refuge
O_3	ozone
OCS	Outer Continental Shelf
OCSLA	Outer Continental Shelf Lands Act
OPAREA	Operating Area
OSV	offshore support vessel
PAH	polycyclic aromatic hydrocarbon
Pb	lead
PCH	Porcupine Caribou Herd
PINS	Padre Island National Seashore
$PM_{2.5}$	particulate matter measuring 2.5 microns or less in diameter
PM_{10}	particulate matter measuring 10 microns or less in diameter
ppb	parts per billion
Program	2017–2022 OCS Oil and Gas Lease Sale Program
Programmatic EIS	Programmatic Environmental Impact Statement
PSD	Prevention of Significant Deterioration
SAAQS	State Ambient Air Quality Standards
SAFMC	South Atlantic Fisheries Management Council
SFA	Sustainable Fisheries Act
SIP	State Implementation Plan
SO_2	sulfur dioxide
SUA	special use airspace
TAPS	Trans-Alaska Pipeline System
TCH	Teshekpuk Lake Caribou Herd
TPAH	Total polycyclic aromatic hydrocarbon
TPH	total petroleum hydrocarbon
UME	unusual mortality event
UCI	Upper Cook Inlet
U.S.	United States
USDA	U.S. Department of Agriculture
USDOD	U.S. Department of Defense
USDOI	U.S. Department of the Interior
USEIA	U.S. Energy Information Administration
USEPA	U.S. Environmental Protection Agency
USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
WAH	Western Arctic Herd
WHSRN	Western Hemisphere Shorebird Reserve Network

1. INTRODUCTION

This Programmatic EIS addresses four program areas as described in **Chapter 2**. The material in this appendix was developed as a supplement to the Affected Environment described in **Section 4.3** of the Programmatic EIS. The more comprehensive information in this appendix is meant to provide context to the reader for the resource areas discussed in **Chapter 4**.

2. 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 2015, 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., people with asthma, children, and older populations), and (2) secondary standards to protect public welfare and quality of life, including protection against degraded visibility and damage to animals, crops, vegetation, and buildings. **Table C-1** presents the current primary and secondary NAAQS for the six criteria pollutants.

Table C-1. 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
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 $\mu g/m^3$	Annual mean, averaged over 3 years
		Secondary	Annual	15 $\mu g/m^3$	Annual mean, averaged over 3 years
		Primary and Secondary	24-hour	35 $\mu g/m^3$	98th percentile, averaged over 3 years
	PM_{10}	Primary and Secondary	24-hour	150 $\mu g/m^3$	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

Key: $\mu g/m^3$ = microgram per cubic meter; PM = particulate matter; ppb = parts per billion; ppm = parts per million.

A state can adopt more stringent standards, called State Ambient Air Quality Standards (SAAQS). If a state has no standard corresponding to 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 CAA, 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 a deadline be set for the area to again attain the standard, depending on the air quality problems' severity. Only areas within state boundaries are classified as attainment, nonattainment, or unclassifiable; therefore, there is no attainment status for the OCS.

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 a state will impose on pollutant sources. SIPs must be regularly updated and must demonstrate to the USEPA the NAAQS will be attained and maintained. Nonattainment areas, where air quality has improved to meet the NAAQS, are re-designated 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, preventing "polluting up to the standard" (**Table C-2**).

Table C-2. 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 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 the permitting authority notify Federal Land Managers (FLMs) when a proposed PSD source would be within 100 km (62 mi) of a Federal Class I Area. If the source emissions are considered large, the USEPA recommends 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. WATER QUALITY

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 can be closely linked. Contaminants, which are associated with suspended load, ultimately can 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.

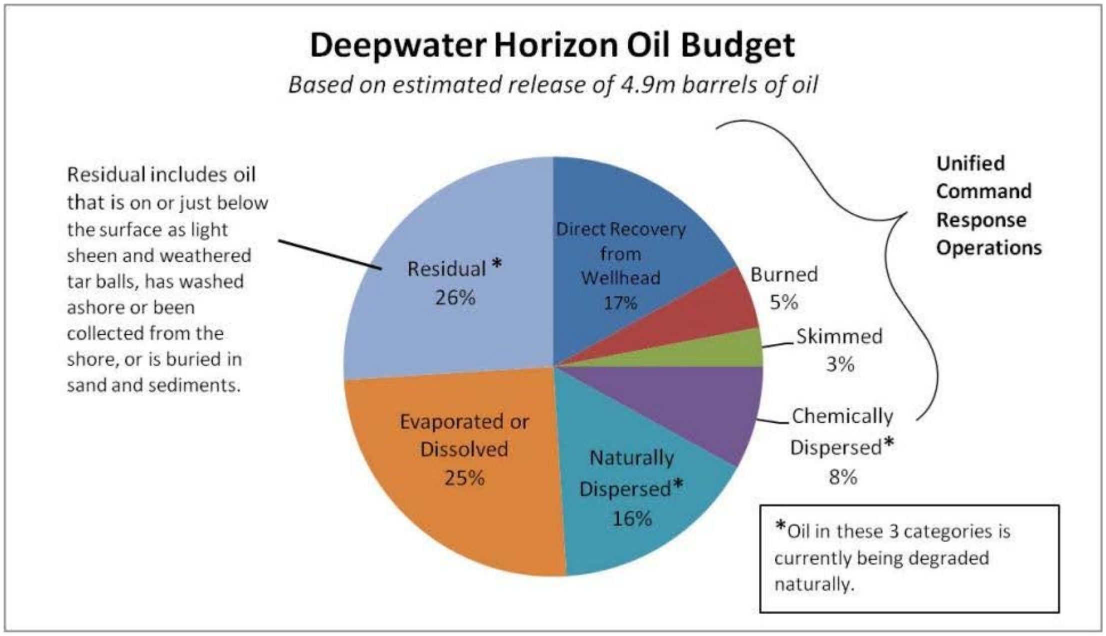
Water quality is evaluated by measuring factors that are considered important to an ecosystem's health. The primary factors influencing coastal and marine water quality are temperature, salinity, dissolved oxygen, chlorophyll content, nutrients, pH, oxidation reduction potential (Eh), pathogens, transparency (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 anti-degradation 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 GULF OF MEXICO PROGRAM AREA

Deepwater Horizon Explosion, Oil Spill, and Response

The *Deepwater Horizon* explosion, oil spill, and response event released to the GOM an estimated 4.93 million barrels (bbl) of oil (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 (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-1**).



Source: Lubchenco et al. 2010

Figure C-1. Fate of Oil Released during the *Deepwater Horizon* Explosion, Oil Spill, and Response Event

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 could 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 could 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 of GOM 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 on 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 on 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 northeastern GOM 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 (*Vibrio fischeri*) via microtox assay, 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 years 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.

4. MARINE BENTHIC COMMUNITIES

Please see **Section 4.3.3** in the Programmatic EIS for a description of the affected environment for marine benthic communities.

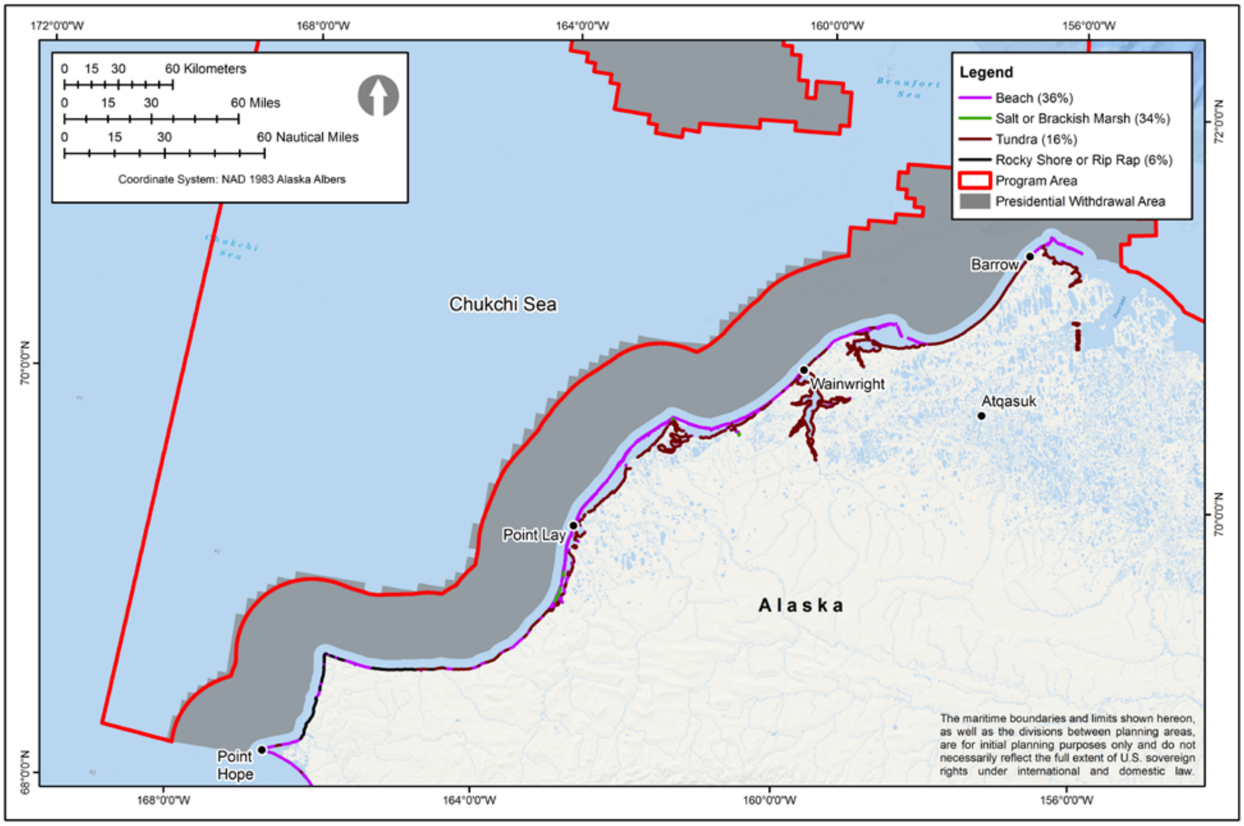
5. COASTAL AND ESTUARINE HABITATS

5.1 ALASKA PROGRAM AREAS

5.1.1 *Beaufort Sea and Chukchi Sea Planning Areas*

5.1.1.1 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 Sea 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 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-2** and **C-3**.



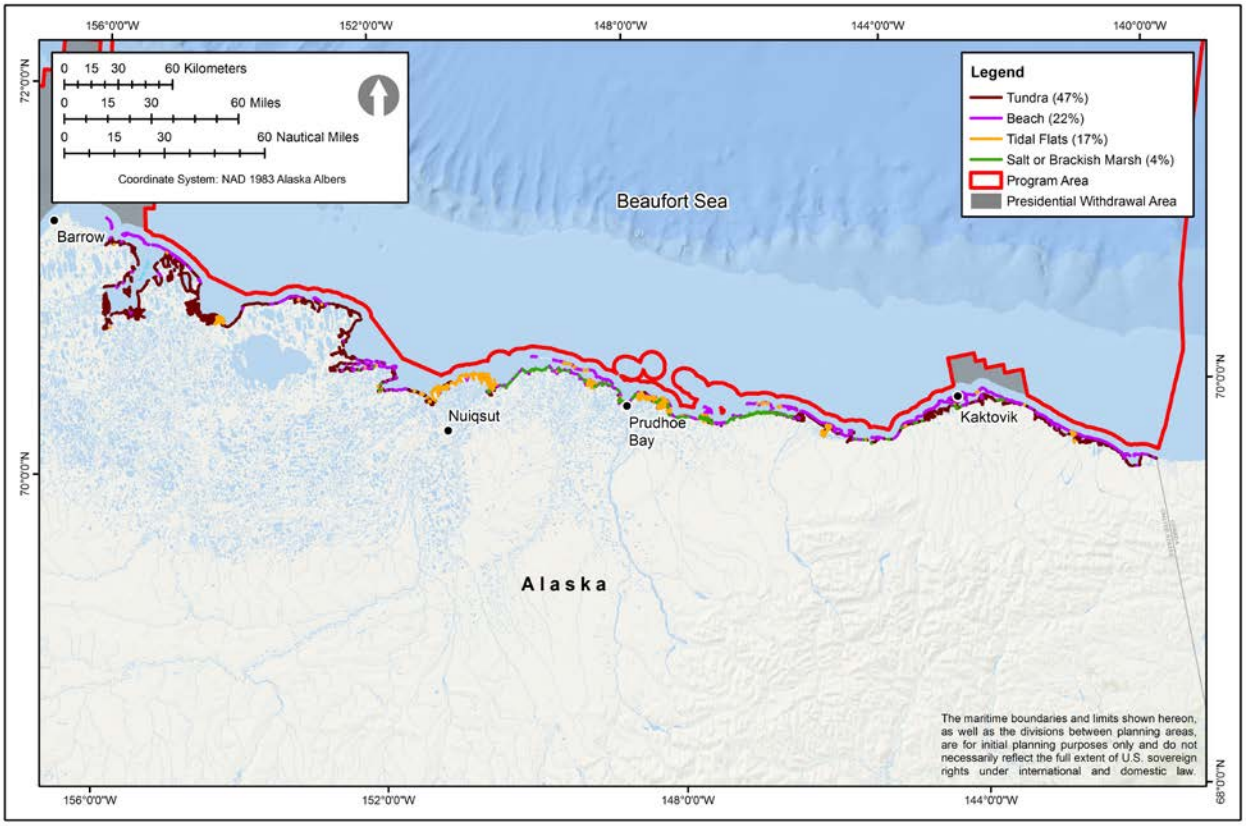
Source: NOAA 2015

Figure C-2. Coastal and Estuarine Habitats of the Chukchi Sea Program Area

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 (NOAA 2013).



Source: NOAA 2015

Figure C-3. Coastal and Estuarine Habitats of the Beaufort Sea Planning Area

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).

5.1.1.2 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, NOAA 2013). Although many barrier islands are low-lying, some of the barrier islands along the Chukchi coastline such as Cape Lisburne front steep cliffs cut into bedrock up to 260 m (853 ft) high (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).

5.1.1.3 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-2**). In the Beaufort Sea, 22 percent of the shoreline is beach (**Figure C-3**).

5.1.1.4 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-2** and **C-3**).

5.1.1.5 Rocky Shores

In some areas, along the Chukchi 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.

5.1.1.6 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-4a** and **C-4b**, 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 (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 (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 (BOEM 2012a).

5.1.1.1 Wetlands and Marshes

The ACP 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. In the Beaufort Sea and Chukchi Sea Planning Areas, coastal salt marshes are generally thin bands, often only a few meters in extent due to disturbance from sea ice and the small tidal amplitude (Viereck et al. 1992).

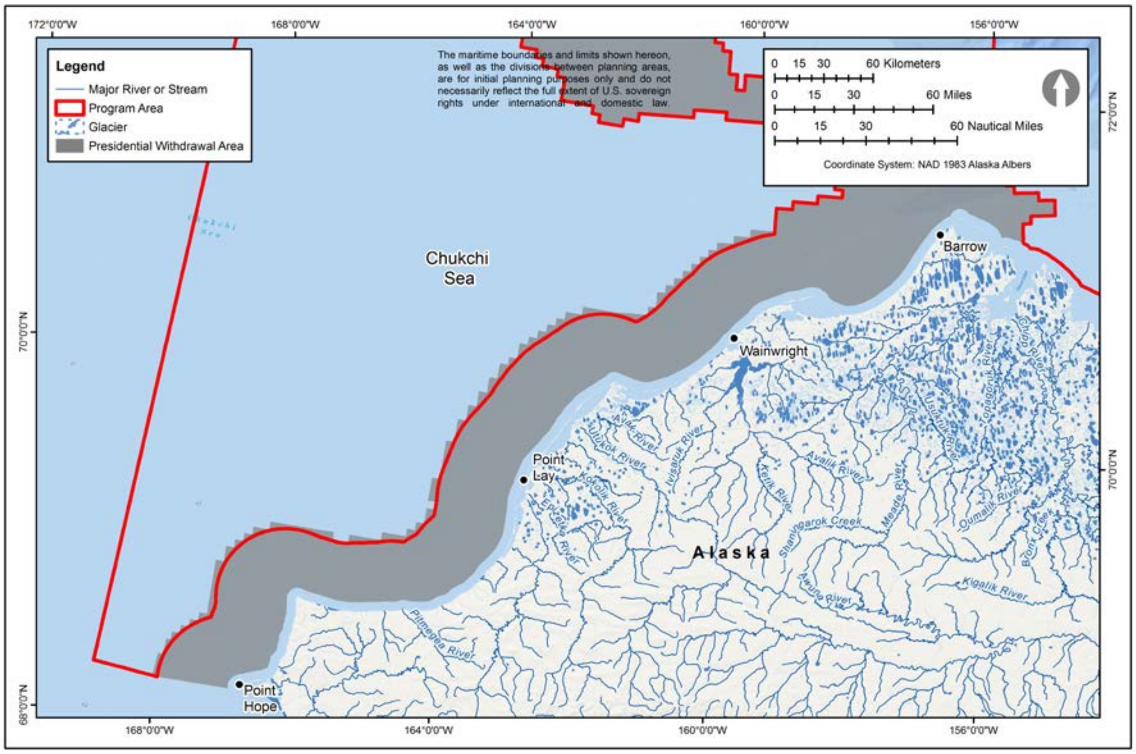


Figure C-4a. Major Rivers entering the Beaufort Sea and Chukchi Sea Planning Areas (1 of 2)

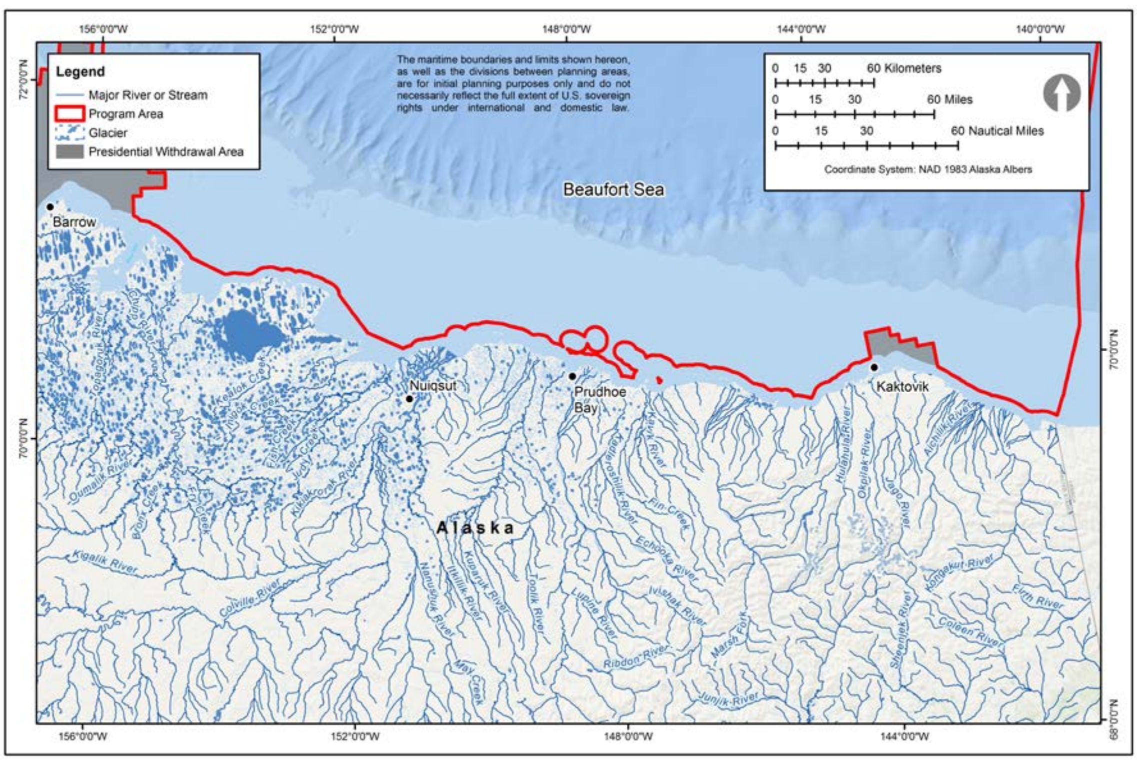


Figure C-4b. Major Rivers entering the Beaufort Sea and Chukchi Sea Planning Areas (2 of 2)

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-3**).

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-2**).

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).

5.1.1.2 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 (BOEM 2012a). The distribution and extent of these communities are likely limited by the availability of rock and other hard substrates.

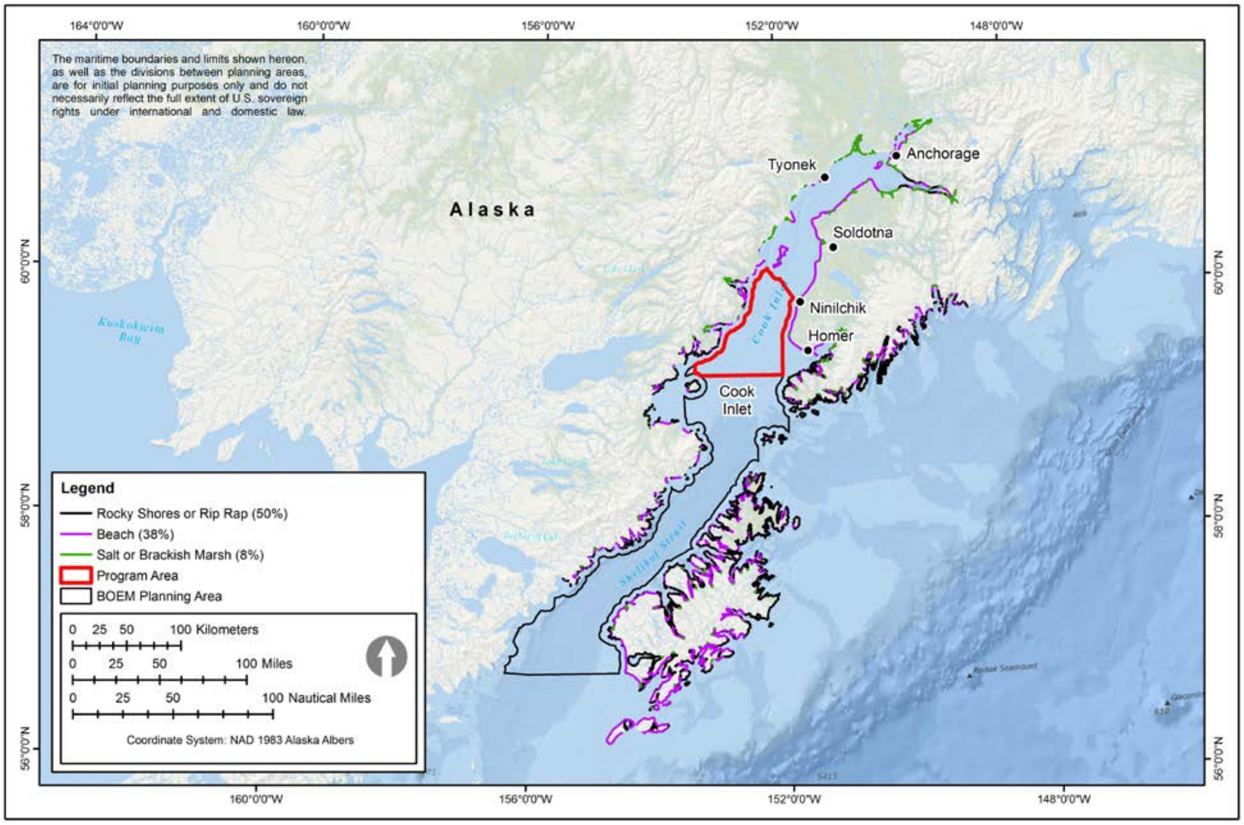
Marine algal communities occur on hard-bottom substrates in several areas along the Chukchi Sea coast such as in Peard Bay, which has an extensive kelp community, Kasegaluk Lagoon, Skull Cliffs, and southwest of Wainwright (Dunton et al. 2004, Phillips et al. 1984). Few known beds occur along the Beaufort 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).

5.1.2 *Cook Inlet Planning Area*

5.1.2.1 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 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-5**.



Source: NOAA 2015

Figure C-5. Coastal and Estuarine Habitats of the Cook Inlet Planning Area

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-6**). There are no barrier islands in the Cook Inlet.

5.1.2.2 Beaches

In Cook Inlet, 38 percent of the shoreline is beach habitat (**Figure C-5**). 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.

5.1.2.3 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 (NOAA 2002).

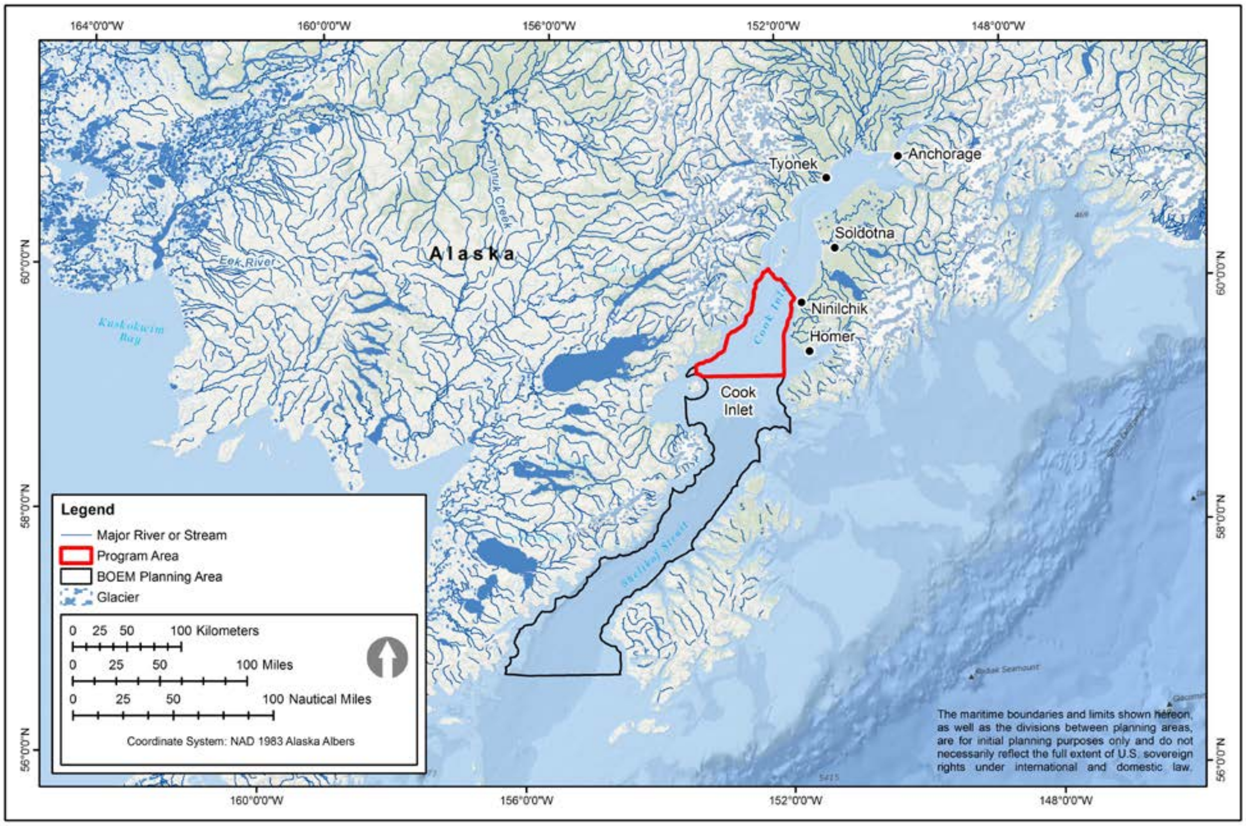


Figure C-6. River Systems and Rivers entering Cook Inlet

5.1.2.4 Rocky Shores

There are several rocky shore features, including beach rubble, boulders, rocky ledges, and cliff faces, 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, near Tuxedni Channel; and Gull Island, in Kachemak Bay outside the lease sale area (NOAA 2002). These areas represent 50 percent of the Cook Inlet coastline (**Figure C-5**).

5.1.2.5 Tidal Rivers

Three major river systems discharge into upper Cook Inlet: the Knik, Matanuska, and Susitna Rivers (**Figure C-6**). 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-6**). 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*) (Fall 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.

5.1.2.1 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 could be flooded during storm surges. Upper areas of coastal marshes could 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 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-5**). 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).

5.1.2.2 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 eastern 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).

5.2 GULF OF MEXICO PROGRAM AREA

This section describes coastal and estuarine habitats in the GOM 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 GOM are considered either coastal or marine. Coastal habitats include the estuarine areas along virtually the entire U.S. coast of the GOM. Marine habitats occur seaward of these coastal habitats. The most seaward coastal feature, typically barrier islands or beaches in the GOM, 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 (BOEM 2012b).

GOM coastal habitats are associated with a nearly continuous estuarine ecosystem comprising 31 major estuarine watersheds that extend across the northern GOM. 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 farther 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” GOM 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 a large extent, variations in the interactions among these terrestrial and marine processes and properties distinguish the three coastal ecoregions that characterize the northern GOM (BOEM 2012b).

5.2.1 *Seagrass Habitats*

Seagrasses are a vital component of the GOM coastal ecology and economy (Dawes et al. 2004). Seagrasses provide myriad 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 GOM includes waters adjacent to five states: Texas, Louisiana, Mississippi, Alabama, and Florida, known collectively as the “Northern Gulf Region” (**Figure C-7**). 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 terminates at the easternmost reaches of Florida Bay. It includes the northern boundary of the Florida Keys and the Dry Tortugas, within the southeastern section of the Eastern Planning Area (Dawes et al. 2004, USEPA, Gulf of Mexico Program 2004). The vast majority, 88 percent, of northern GOM seagrasses are found around Florida (Yarbro and Carlson 2011).

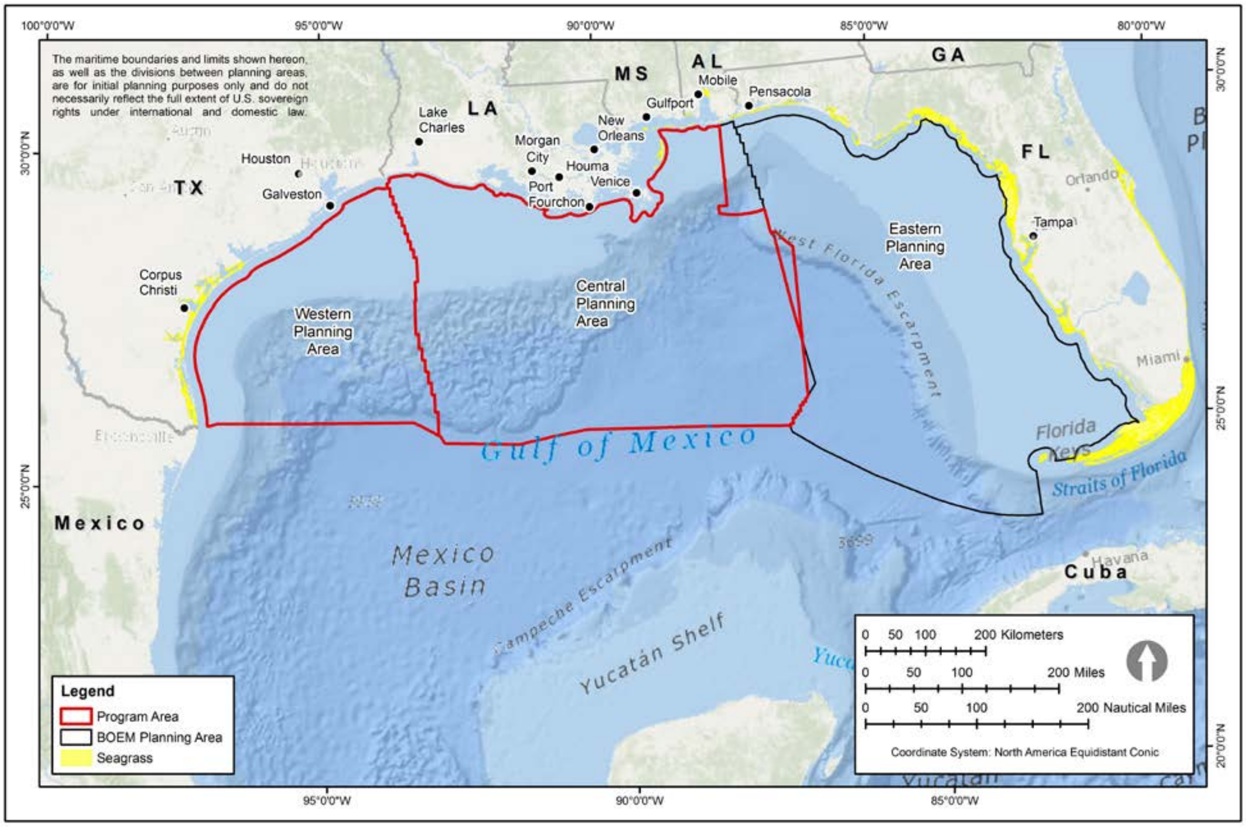


Figure C-7. Seagrass Distribution in the Gulf of Mexico

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 to be impacted from non-routine OCS activities.

5.2.1.1 Western Gulf of Mexico Planning Area

Seagrasses in the western GOM 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 GOM (11 percent, 92,854 ha [229,447 ac]). The majority (74 percent) of these are in the broad shallows of the Laguna Madre (BOEM 2012b). Laguna Madre, along with other coastal bays in Texas, falls outside of the GOM Program Area, but these regions could be affected by anticipated activities in the OCS.

5.2.1.2 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 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 years, three tropical cyclones made landfall near or on the Louisiana coast. These included Hurricane Humberto (2007), Tropical Storm Edouard (2008), and Hurricane Gustav (2008) (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 (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 (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, Inc. 2003); its presence was reconfirmed by Byron and Heck (2006).

5.2.1.3 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 below.

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 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 the seagrass census for the eastern GOM 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 western coast of Florida. The majority of the resource is 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 (CSA 1985, CSA 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).

5.2.2 *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” (40 CFR 230.3 and 33 CFR 328.3).

Wetlands are important, providing a number of ecological benefits (**Table C-3**). In the GOM, 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 GOM provide large-scale opportunities for commercial and recreational activities.

Table C-3. 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 GOM: 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, BOEM 2012b) (**Figure C-8**). 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).

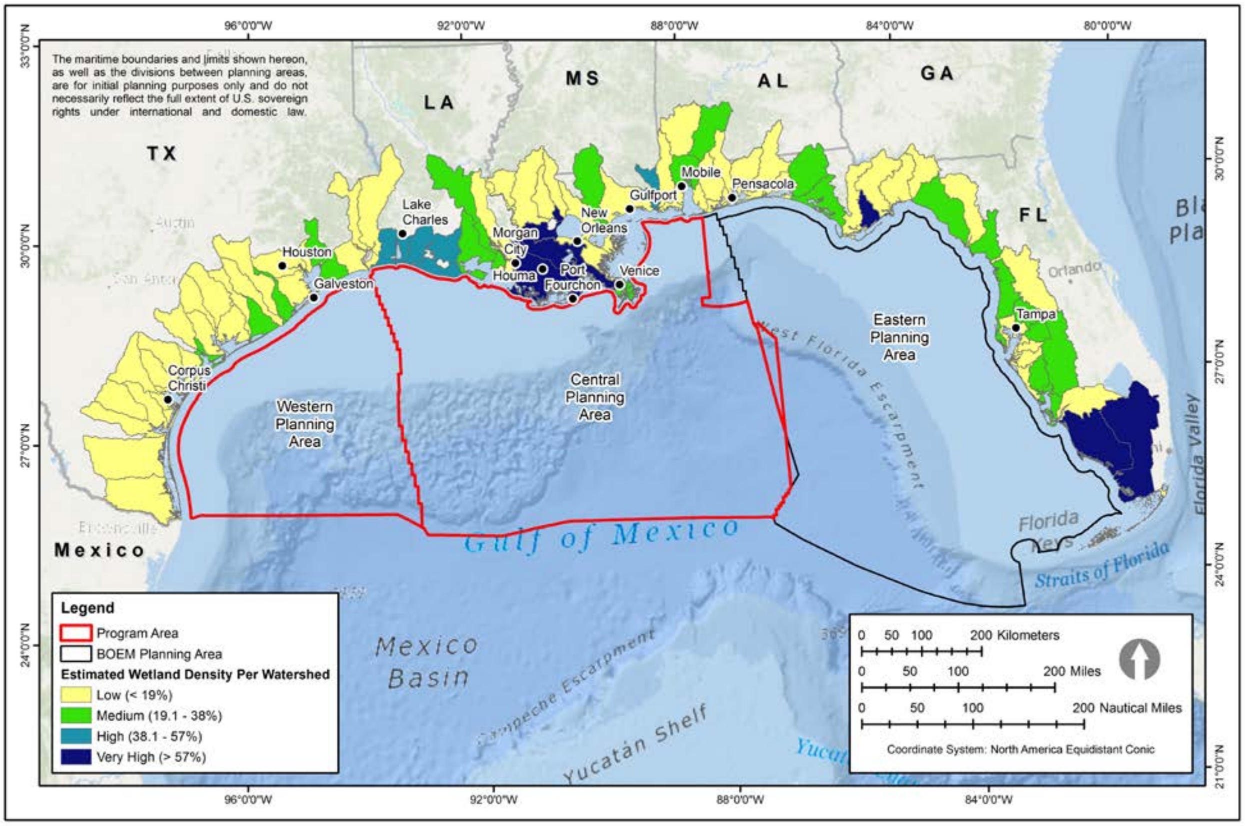


Figure C-8. Coastal Wetlands adjacent to the Gulf of Mexico

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 GOM'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 GOM 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.

5.2.2.1 Western Gulf of Mexico Planning Area

The emergent coastal wetlands around the GOM 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, BOEM 2012b). 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 (BOEM 2012a).

5.2.2.2 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 (BOEM 2012a). 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 GOM 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 (BOEM 2012b). Freshwater wetlands are extensive on the Chenier Plain. While tidal influence is minimal, these wetlands could be inundated by strong storms (BOEM 2012b).

The Mississippi Alluvial Plain encompasses the eastern half of Louisiana’s coasts including Barataria Bay, Terrebonne Bay, and the Mississippi Delta (BOEM 2012b, USEPA 2013). Extensive salt marsh and brackish marsh occurs throughout this coastal region, with intermediate and freshwater marsh systems occurring further inland (Handley et al. 2012, 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 (BOEM 2012a). Marshes in Mississippi are more stable than those of either Alabama or Louisiana, reflecting a more stable substrate, and continued, active sedimentation (BOEM 2012a). In Alabama, most of the wetlands are 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, BOEM 2012a). Major causes of marsh loss in Alabama have included industrial development, navigational dredging, natural succession, and erosion-subsidence (Roach et al. 1987, BOEM 2012a).

5.2.2.3 Eastern Gulf of Mexico Planning Area

Although the Eastern GOM 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 (FDEP 2015, 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 (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 GOM coast to address the issue of erosion and attendant land losses, including more recent efforts associated with the 2012 RESTORE Act (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.

5.2.3 *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 could cause shoreline deterioration (Byrnes et al. 2013, Khalil et al. 2013, CPRA 2014, Ford 2014, BOEM 2015a). 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. GOM 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, BOEM 2015a). Barrier island beaches usually comprise a shoreface, foreshore, and backshore (Frey and Howard 1969, 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 (BOEM 2012b). The backshore is the area between the beach berm crest and dunes, and could be sparsely vegetated. The berm crest and backshore could 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, 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, BOEM 2015a). Most of the geographic changes experienced by barrier islands are due to storms, subsidence, deltaic influence, longshore drift, or anthropogenic stressors (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 GOM are migrating laterally to some extent (BOEM 2012b), although some of the beaches on the western coast of Florida are either stable or slowly accreting given typical low wave energy and frequent renourishment (Morton et al. 2005). Most GOM 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 (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).

5.2.3.1 Western Gulf of Mexico 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 GOM's coast have been transformed into transgressive landforms, effectively causing erosion and landward sediment movement (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 (BOEM 2012b). East to Atchafalaya Bay, Louisiana, is primarily marshland, with no barrier island beaches.

5.2.3.2 Central Gulf of Mexico Planning Area

The barrier islands of the northern GOM stretch from Atchafalaya Bay, Louisiana, to Mobile Bay, Alabama (BOEM 2012a, BOEM 2013). Beaches here are generally eroding and deterioration of barrier islands occurs as a result of reduced sediment availability and transport, sea level rise, frequent tropical and winter storms, and topographic and geomorphic features (Otvos and Carter 2008, McBride et al. 1992, BOEM 2012a, Byrnes et al. 2013, Khalil et al. 2013, 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 (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 (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).

5.2.3.3 Eastern Gulf of Mexico Planning Area

The western 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 southwestern 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).

6. PELAGIC COMMUNITIES

Please see **Section 4.3.5** in the Programmatic EIS for a description of the affected environment for pelagic resources.

7. 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 (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 northern GOM 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 GOM and sea otters, walruses, and polar bears in Alaskan waters.

7.1 ALASKA PROGRAM AREAS

This section provides a regional summary description of marine mammals in the Alaska program areas (**Figure 2.1-1** of the Programmatic EIS). **Figure C-9** demonstrates biologically important areas (BIAs) for some of the mammalian species found in Alaskan waters in reference to the Alaskan planning areas and Presidential Withdrawal areas.

7.1.1 *Beaufort Sea and Chukchi Sea Planning Areas*

7.1.1.1 Listed under the Endangered Species Act

There are four species of marine mammals in the Beaufort and Chukchi Seas that are listed under the ESA. These four species include three mysticetes and one fissiped. The Pacific walrus is a candidate species under the ESA.

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). Bowhead feed on zooplankton, such as copepods and euphausiids.

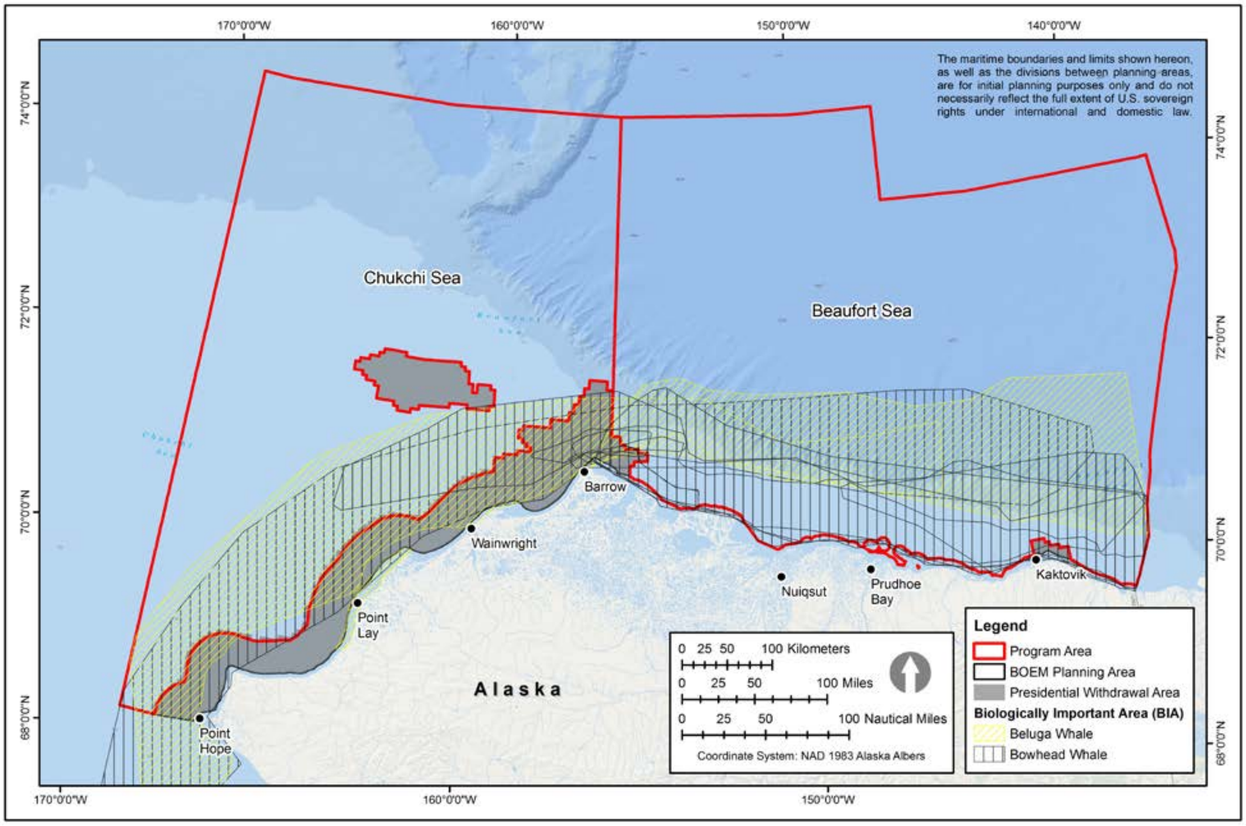


Figure C-9. Biologically Important Areas for Beluga and Bowhead Whales offshore Alaska

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. (2010) 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 nearshore leads 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 feed upon small schooling fish and invertebrates.

Fin whales usually breed and calve in the warmer waters of their winter range (Mizroch 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 (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 (Clarke 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/southeastern 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).

Pacific Walrus (*Odobenus rosmarus divergens*)

The Pacific walrus (*Odobenus rosmarus divergens*), a candidate for ESA listing (USFWS 2015a, 79 FR 72450), 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 (Garlich-Mille et al. 2011). 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 (USFWS 2009a). 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 (USFWS 2014a). Two large Arctic areas are occupied by Pacific walruses during summer — from the Bering Strait west to Wrangell Island, and along the northwestern coast of Alaska from close to Point Hope to north of Point Barrow. Although a few Pacific walruses 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 occasionally overwinter in the Beaufort and Chukchi Seas. Walrus feed primarily on benthic invertebrates, such as clams and worms. Some walrus occasionally prey upon seals or seabirds.

USFWS (2014a) provided estimates of the Pacific walrus population over the past several centuries. A minimum population of 200,000 animals occurred in the 18th and 19th 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 (USFWS 2015b). Major stressors to the Pacific walrus are subsistence harvest with a total of 969 harvested in 2011 (USFWS 2012), and loss of sea ice (Garlich-Miller et al. 2011).

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 primarily from Point Barrow, Alaska, west to the eastern Siberian Sea, but could also occur as far east as the Colville River delta. The stock's southern boundary in the Bering Sea is determined by the annual extent of the pack ice (USFWS 2010a). 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 (75 FR 76086). 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 (78 FR 11766). 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 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. 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 (73 FR 28212). 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 (USFWS 2010a). 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 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 sub-adult 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 (81 FR 36664). 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 (81 FR 36664).

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, USFWS 2015c), walrus 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 can 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 (73 FR 28212).

A reliable population estimate for the Chukchi/Bering Seas Stock does not exist, but the best information available suggests a population estimate of 2,000 individuals for the stock. There also is no reliable population trend for this stock (USFWS 2010a). 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 (USFWS 2015c).

7.1.1.2 Not Listed under the Endangered Species Act

Of the 15 species of marine mammals in the Arctic region (Beaufort and Chukchi Seas), 10 are not listed under the ESA. The mysticetes account for two of these species while four species are odontocetes. There are also four species of pinnipeds. Information on each species or species group, where appropriate, is provided in **Table C-4**.

7.1.1.3 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 (NMFS 2011a). The USFWS also identified diseased and dead walruses at the annual mass haul out at Point Lay (NMFS 2011a). 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 (NMFS 2011a). 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 (NMFS 2013, NMFS 2014a). Only three new cases of the disease were found in the Pacific walrus from field studies in 2012 through 2013 (NMFS 2014a). 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.

7.1.2 *Cook Inlet Planning Area*

7.1.2.1 Listed under the Endangered Species Act

There are nine marine mammal species that 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 could 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. 2000, 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-24) for the North Pacific right whale in April 2008 (73 FR 19000).

Table C-4. 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 southeastern Alaska • Consists of Eastern North Pacific Northern Resident Stock • Some 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 2008b)	460,268	391,000	2012
Bearded seal *Erignathus barbatus nauticus)*	• Bering, Okhotsk and portion of Arctic Ocean subspecies • Ice-obligate species, feeds primarily on benthic invertebrates	N/A	299,174	2012

Non-Listed Species	Distribution	Abundance Estimate	Abundance Estimate Minimum	Last Survey
	• Reliable population estimate not available			
Ringed seal (*Phoca hispida hispida*)	• Arctic Ocean and Bering Sea • Ice-obligate species, pisciverous • Possibility of separate breeding populations within Alaska stock	170,000 (preliminary analysis)	N/A	2013

Sources: Abundance data from Allen and Angliss (2014), except for the gray whale, bearded and ringed seals. Gray whale abundance data from Allen and Angliss (2011). Bearded and ringed seal data from Conn et al. 2014.
Key: N/A = not available

Blue Whale (*Balaenoptera musculus*)

The blue whale (*Balaenoptera musculus*) primarily occurs south of the Aleutian Islands and the Bering Sea (Berzin and Rovnin 1966, NMFS 2015b). 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.

The blue whale is not expected to occur within Cook Inlet. Blue whales tend to occur alone or in pairs, but aggregations of 12 or more could 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, NMFS 2015b). 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).

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 (MMS 1996). Some fin whales feed in the Gulf of Alaska, including near the entrance to Cook Inlet (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, Brueggeman 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, NMFS 2015b). 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 (Carretta et al. 2014); while abundance estimates for the Hawaiian Stock are 178 with a minimum abundance of 93 (Carretta et al. 2014, Allen and Angliss 2014).

Humpback Whale (*Megaptera novaeangliae*)

Members of the Western North Pacific and Central North Pacific Stocks of humpback whales occur 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, Rugh et al. 2007). The Kodiak Island area supports a feeding aggregation of humpback whales (Waite et al. 1999).

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 (MMS 1996), 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 (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 could 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, 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 beluga whales are considered part of the Cook Inlet Stock (Laidre et al. 2000).

NMFS designated 7,800 km2 (3,013 mi2) of critical habitat for the Cook Inlet DPS of beluga whales on April 11, 2011 (76 FR 20180) (**Figure C-10**). 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 (NMFS 2008a). 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 beluga whales from spring through fall (NMFS 2008a, 76 FR 20180). 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 could be important to the winter survival and recovery of Cook Inlet beluga whales (NMFS 2008a, 76 FR 20180).

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 (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 km2 (1,083 mi2). 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 (NMFS 2008a).

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 66140), while the Western Stock encompasses the range of the Western DPS that is listed as endangered under the ESA (58 FR 45269). 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 could enter rivers in pursuit of prey (NMFS 2008b). 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) (58 FR 45269).

Steller sea lion rookeries and hundreds of haul outs occur within the range of the Western Stock of the Steller sea lion (NMFS 2008b, Allen and Angliss 2011). The locations of the rookeries and haul outs change little from year to year (58 FR 45269). Major rookeries in and near Cook Inlet include Outer Island, Sugarloaf Island, Marmot Island, Chirikof Island, and Chowiet Island. There are several major haul outs 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-10**). 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 (58 FR 45269). Haul outs are areas used for rest and refuge by all sea lions during the non-breeding season and by non-breeding adults and sub-adults during the breeding season. Some rookeries are used as haul outs after the breeding season is over. In addition to rocks, reefs, and beaches normally used as haul outs, sea lions also could use sea ice and man-made structures such as breakwaters, navigational aids, and floating docks (58 FR 45269). Sea lion critical habitat includes a 32 km (20 nmi) buffer around all major haul outs 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 (58 FR 45269). The minimum population estimate for the Steller sea lion western stock is 48,676 (Allen and Angliss 2014).

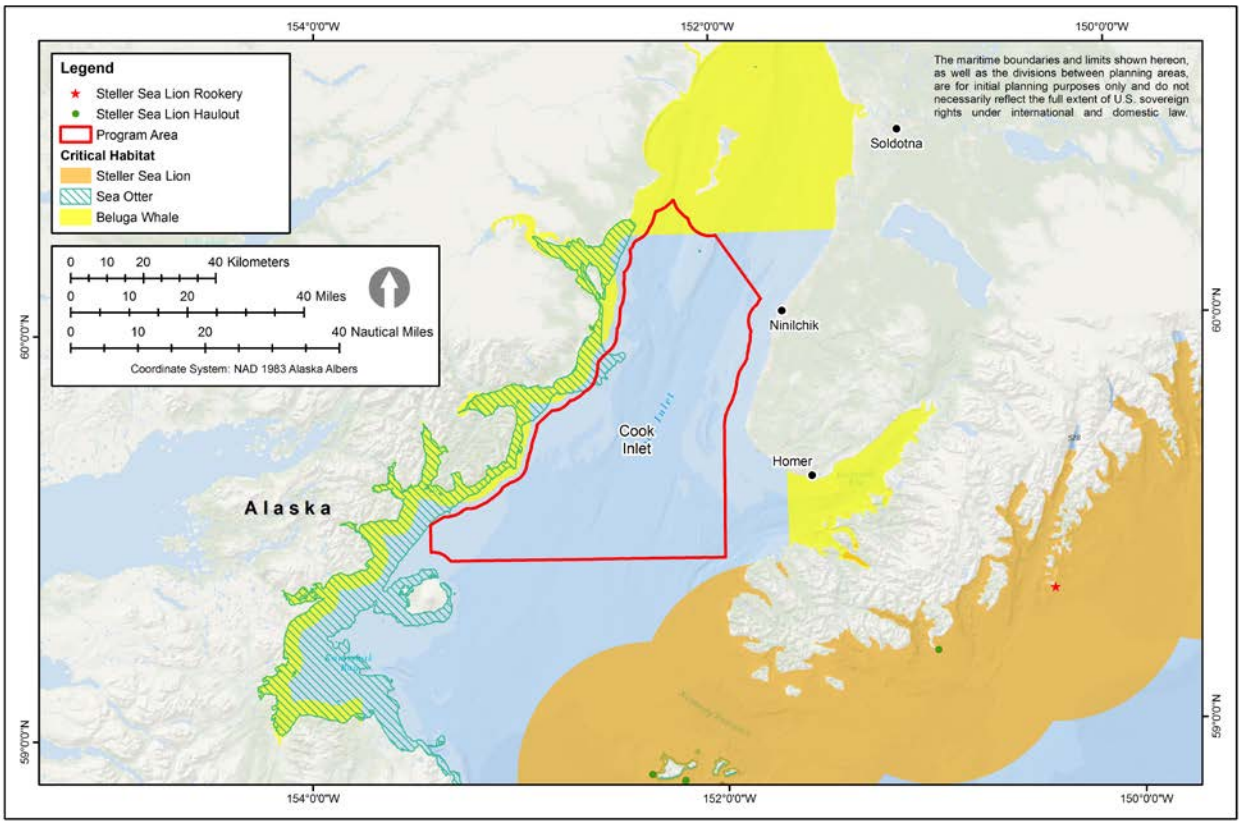


Figure C-10. Critical Habitat of the Steller Sea Lion, Sea Otter, and Beluga Whale in Cook Inlet

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 (70 FR 46366).

Five units totaling 15,164 km^2 (5,855 mi^2) are designated as critical habitat for the Southwest Alaska DPS (74 FR 51988) (**Figure C-10**). Unit 5 (Kodiak, Kamishak, Alaska Peninsula), containing 6,755 km^2 (2,607 mi^2) of critical habitat (74 FR 51988), 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 (74 FR 51988). 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 (74 FR 51988). The lower western half of Cook Inlet to Redoubt Point is included in Unit 5 of the critical habitat (74 FR 51988).

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 (USFWS 2008). 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).

The recovery and expansion of the sea otter populations in Prince William Sound and in southeastern 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, USFWS 2014b). Among marine mammals, sea otters probably have one of the highest 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 (USFWS 2008). The South Central Alaska Stock's population trend is stable, while the Southwest Alaska Stock is declining (USFWS 2008). 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 (USFWS 2010b).

7.1.2.2 Not Listed under the Endangered Species Act

Seven species of cetaceans and two 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. Appropriate information for each species or species group is provided in **Table C-5**.

Table C-5. 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) (NMFS 2015b)	N/A	N/A	N/A
Dall's porpoise (*Phocoenoides dalli*)	• Present year-round throughout its entire range in the northeastern 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 (Dahlheim et al. 2000) • Gulf of Alaska Stock occurs from Cape Suckling to Unimak Pass (Allen and	31,046	25,987	1998

Non-Listed Species	Distribution	Abundance Estimate	Abundance Estimate Minimum	Last Survey
	Angliss 2014)			
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
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 southeastern 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 occurring 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

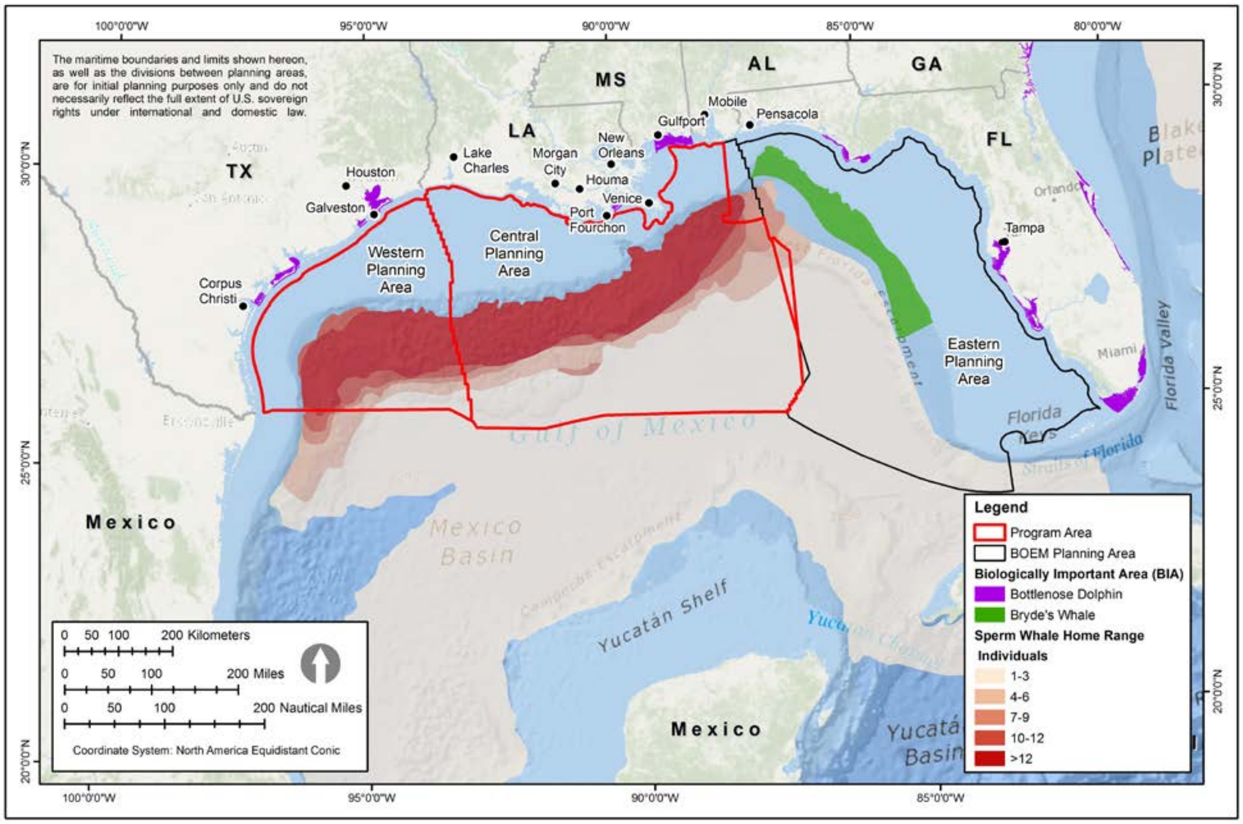
Sources: Abundance data taken from Allen and Angliss (2014) Stock Assessment except for the gray whale. Gray whale abundance data taken from Carretta et al. (2014).
Key: N/A = not available

7.2 Gulf of Mexico Program Area

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

7.2.1.1 Listed under the Endangered Species Act

There are two marine mammal species that occur in the GOM Program Area that are federally listed as endangered species (NMFS 2015b). These include one toothed whale, the sperm whale, and the Florida subspecies of the West Indian manatee (*Trichechus manatus*) (Waring et al. 2016 NMFS 2015b). The sperm whale is common in OCS waters (shelf edge and slope) of the GOM Program Area (**Figure C-11**). The West Indian manatee occurs regularly in the GOM, primarily in nearshore areas (Würsig et al. 2000, Mullin and Fulling 2004).



Source: Jochens et al. 2008

Figure C-11. Spatial Representation of Sperm Whale Home Range and Locations of Biologically Important Areas for Bottlenose Dolphin and Bryde's Whale in the Gulf of Mexico

Sperm Whale (*Physeter macrocephalus*)

Sperm whales are cosmopolitan in their distribution, ranging from tropical latitudes to pack ice edges in both hemispheres. In the GOM, sperm whales can be found most commonly in the Central Planning Area, but also occur in the Eastern and Western Planning Areas. 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 (Whitehead et al. 2012). Genetic studies of GOM sperm whales found significant genetic differentiation in matrilineally inherited mitochondrial DNA among whales from the northern GOM 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 GOM 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 GOM (Engelhaupt et al. 2009). Results from satellite tagging studies of individual GOM sperm whales that were primarily females and juvenile males found no evidence of seasonal migrations of groups to outside the GOM, but documented GOM-wide movements, primarily along the northern continental slope and in a few cases into the southern GOM. Only one individual, an adult male sperm whale left the GOM 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 GOM were compared to those from other areas of the Atlantic, and suggested that the GOM whales could constitute a distinct acoustic clan. However, the study also found variation in coda patterns between animals in the north-central GOM and the northwestern GOM. From these results, it was suggested that groups of whales from other acoustic clans (e.g., from the North Atlantic) occasionally could enter the northern GOM (Gordon et al. 2008).

The total length of GOM 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. 2016). Based on tagging data, older males could enter the GOM only for breeding, but then may not migrate out of the GOM (78 FR 68032). Sperm whale group size in the GOM 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 GOM 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 GOM have been documented, GOM individuals are genetically distinct from their Mediterranean and North Atlantic relatives (Engelhaupt 2004, Waring et al. 2016). The acoustic dialect used by this group is also different than that of other sperm whales in the North Atlantic (Waring et al. 2016). For these and other reasons including average size and photo-identification, sperm whales in the GOM constitute a Northern Gulf of Mexico Stock that is distinct from other Atlantic Ocean stocks (Waring et al. 2016).

In the GOM, 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-11**) (Mullin et al. 1991, Mullin et al. 1994, Mullin et al. 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 GOM 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 GOM, 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, Davis et al. 2002, Wormuth et al. 2000).

The best abundance estimate available for northern GOM sperm whales, derived from a summer 2009 oceanic survey, is 763 individuals (coefficient variation [CV] = 0.38) (Waring et al. 2016). 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. (2008) 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 GOM at 87 (95 percent CI = 52-146).

The current potential biological removal for GOM sperm whales is 1.1 individuals (Waring et al. 2016). NMFS has not designated critical habitat for sperm whales. Sperm whales were widely harvested from the northeastern Caribbean (Romero et al. 2001) and the GOM, 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 population size, small changes in reproductive parameters such as the loss of adult females, could significantly affect the growth of sperm whale populations (Chiquet et al. 2013). No population trends can be interpreted from data available for the GOM. Changes in abundance will be difficult to interpret without an understanding of sperm whale abundance throughout the GOM. 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. 2016).

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 GOM: 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 (USFWS 2001 and USFWS 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 GOM 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).

7.2.1.2 Not Listed under the Endangered Species Act

Twenty species of cetaceans not listed under the ESA occur in the GOM. There is one baleen whale and 19 species are odontocetes (toothed whales and dolphins). A year-round Biologically Important Area (BIA) has been identified for the resident Bryde's whale population in the Eastern Planning Area (**Figure C-11**). Certain management stocks of common bottlenose dolphin (*Tursiops truncatus*) (Coastal, and Bay, Sound, and Estuary Stocks) found in coastal waters throughout the GOM Program Area are listed as strategic stocks under the MMPA and also have BIAs identified in the GOM (**Figure C-11**). Additional information relative to each species or species group is provided in **Table C-6**.

Table C-6. 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. 2016): o Northern GOM Oceanic Stock encompasses the waters from the 200 m (656 ft) depth contour to the seaward extent of the U.S. EEZ o 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 o 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) o Northern GOM Bay, Sound, and Estuary Stocks (comprising 31 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: largely unknown (refer to Waring et al. 2016)	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: largely unknown (refer to Waring et al. 2016)	Northern GOM Oceanic: 2009 Northern GOM Continental: 2011 GOM Coastal: Eastern: 2011; Northern: 2011; Western: 2011 Northern GOM B/S/E: 2007/2008

Non-Listed Species	Distribution	Abundance Estimate	Abundance Estimate Minimum	Last Survey
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 2002, Jefferson et al. 2008) • Sighted offshore Louisiana in every season of the GulfCet surveys	129	64	2009
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 2002, Waring et al. 2016) • 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)	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

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

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*)	• 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) (Waring et al. 2016) • 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

Source: Abundance data taken from Waring et al. 2016
Key: B/S/E = bays, sounds, and estuaries; GOM = Gulf of Mexico; N/A = not available

7.2.1.3 Unusual Mortality Event for Cetaceans in the Gulf of Mexico

On December 13, 2010, NMFS declared a UME 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 May 26, 2016, a total of 1,141 cetaceans have stranded since the start of the UME (NMFS 2015c). Five percent of these stranded alive and 95 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 (NMFS 2015c). The highest concentration of strandings has occurred off eastern Louisiana, Mississippi, Alabama, and the Florida Panhandle, with a lesser number off western Louisiana (NMFS 2015c). The 1,141 animals include 13 dolphins killed during a fish-related scientific study, and 1 dolphin killed incidental to a dredging operation (NMFS 2015c).

A recent tissue study has shown that petroleum contaminants were a likely source for the lung and adrenal lesions observed in the bottlenose dolphin (NMFS 2015d). 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 (NMFS 2015c). As of October 27, 2015, 68 out of 210 dolphins tested positive for *Brucella* (NMFS 2015c). 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 (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 a 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; NMFS 2015f). The cause for the UME is still undetermined.

7.2.1.4 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 (NMFS 2015g). 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 (NMFS 2015c). Recent tissue studies have been published on lung and adrenal lesions from bottlenose dolphins in Barataria Bay that were likely caused by petroleum contaminants (NMFS 2015g). 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 (NMFS 2015f).

8. 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 (NMFS 2011b). The Northwest Atlantic population of the loggerhead turtle is currently classified as threatened (79 FR 39856; NMFS 2011c). 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.

8.1 GULF OF MEXICO PROGRAM AREA

Five species of sea turtles occur in all three GOM Planning Areas. These are the green, hawksbill, Kemp's ridley, leatherback, and loggerhead turtles. All swim and use coastal beaches within the GOM 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 GOM Program Area. Important marine habitats for sea turtles in and adjacent to the GOM Program Area include nesting beaches, estuaries and embayments, and nearshore hard-substrate areas. Nesting occurs on sandy beaches from Texas to Florida.

Most sea turtles exhibit different habitat distributions during their various life stages of hatchling, juvenile, and adult (Márquez 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 (NMFS and USFWS 2008, Hirth 1997). These hatchlings could have originated at nesting sites along GOM shores, or adjacent areas such as the Caribbean Sea.

Loggerhead Turtle (*Caretta caretta*)

Loggerhead turtles are the most common sea turtle species in the GOM Program Area. In the GOM, loggerhead turtles nest primarily in southwestern 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 past two decades has been estimated to range from 47,000 to 90,000 (USFWS 2015d). 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 (NMFS and 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 GOM (and other locations outside the program area) was accepted (79 FR 39756).

Green Turtle (*Chelonia mydas*)

Green turtles are found throughout the GOM, but nest in very small numbers on GOM beaches (NMFS and USFWS 2007a). Green turtles are vulnerable to cold temperatures, so in many locations they are found only seasonally within the GOM Program Area (Foley et al. 2007). Green turtles nest infrequently along the GOM coast, with the most important nesting sites outside of the program area along the Atlantic coast of Florida (NMFS and USFWS 2007a). The green turtle population is considered severely depleted in comparison to its estimated historical levels (NMFS and 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 GOM, the Greater and Lesser Antilles, and along the Central American mainland south to Brazil. However, hawksbill turtle nesting on GOM 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 GOM 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 GOM 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 (NMFS and USFWS 2013a).

Kemp's Ridley Turtle (*Lepidochelys kempii*)

The Kemp's ridley turtle is found mainly in the GOM but is occasionally sighted along the Atlantic coast from Florida to New England (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 farther from shore where waters are deeper (NMFS and USFWS 2007b). Survey data from the GOM 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 (Márquez 1990, Ernst et al. 1994, NMFS et al. 2010). In the GOM, 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 southwestern Florida (NMFS and 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 (NMFS and USFWS 2007b). The Kemp's ridley turtle population is severely depleted, and it is considered the most endangered sea turtle (USFWS 1999a).

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 GOM; it is reported to have the widest distribution of any sea turtle (NMFS and USFWS 2013b). The leatherback turtle is the most abundant sea turtle in waters over the northern GOM continental slope (Mullin and Hoggard 2000), but nesting on GOM beaches is rare. Leatherback turtles appear to use both continental shelf and slope waters in the GOM (Fritts et al. 1983a, Fritts et al. 1983b, 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 leatherback turtles (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 (NMFS and USFWS 2013b). Leatherback turtles are highly migratory (Shillinger et al. 2008).

9. BIRDS

9.1 ALASKA PROGRAM AREA

This section discusses the birds that utilize coastal and marine habitats during breeding, feeding, and wintering that might be affected by spills within the Alaska program areas (**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 areas.

9.1.1 *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 National Wildlife Refuge (NWR) (USFWS 2010c), 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 the 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.

Birds occurring within and adjacent to the Beaufort and Chukchi Seas Planning Areas encompass dozens of species that fall into at least 7 orders and 10 taxonomic families, including seabirds, waterfowl, shorebirds, wading/marsh birds, and raptors (**Table C-7**). In addition, various other species could 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 (USFWS 2010c). Bird species within a family share common physical and behavioral characteristics. Because of these commonalities, in **Table C-7**, birds are presented by taxonomic families rather than as individual species.

9.1.1.1 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-8**). These species are the spectacled eider (*Somatria fischeri*) and the Alaskan breeding population of the Steller's eider (*Polysticta stelleri*).

Table C-7. 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 the areas 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*) could remain in areas of open water through the winter (Cornell Lab of Ornithology 2015).
Plovers	Small shorebirds that 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 that 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.
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 that 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.

Table C-8. Federally Listed 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). There is designated critical habitat for spectacled eider in Ledyard Bay in the Chukchi Sea Planning Area.

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 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:

- 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.
- 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.

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.

Spectacled eider exhibits strong migratory connectivity and site fidelity over the course of the annual cycle, thereby creating spatiotemporal bottlenecks that could 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 9.1.2.1**. No critical habitat has been designated for this species within or adjacent to Beaufort Sea and Chukchi Sea Planning Areas.

9.1.1.2 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 59195), respectively.

9.1.1.3 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 (MBTA).

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 Planning Areas and the adjacent coastal habitats are absent in winter (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 (USFWS 2010c). 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 (USFWS 2010c). 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 (USFWS 2010c). 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.

9.1.1.4 Important Bird Areas

IBA sites are designated along the coast, in nearshore waters, or offshore in the Beaufort Sea and Chukchi Sea Planning Areas. IBAs are not afforded regulatory protection unless they occur on protected Federal or state lands (such as USFWS NWRs) or include ESA-designated critical habitat.

9.1.2 ***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, ADNR 2009).

Coastal and marine birds occurring within and adjacent to the Cook Inlet Program Area encompass dozens of species that fall into at least 11 orders and 18 taxonomic families of seabirds, waterfowl, shorebirds, wading/marsh birds, and raptors (**Table C-9**). In addition, various other species could 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.

9.1.2.1 Listed Species

The ADF&G 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 could occur in the Cook Inlet Program Area or adjacent marine and coastal areas (**Table C-10**). These species are the endangered short-tailed albatross (*Pheobastria albatrus*) and the threatened Steller's eider.

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, on the Japanese island of Torishima, where > 60 percent of the short-tailed albatross breeding population occurs (USFWS 2014c). 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 could occur throughout the year (USFWS 2014c). 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 (USFWS 2014c). 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 northern 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 (ADF&G 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 northern side of the Alaska Peninsula to molt (USFWS 2002).

Table C-9. Groups of Coastal and Marine Birds occurring in and adjacent to the Cook Inlet Planning 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.
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.

Representative Taxa	Description
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.

Table C-10. Federally Listed 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

Substantial numbers of Steller's eiders remain in lagoons on the northern side of the Alaska Peninsula in winter until freezing conditions force them out (USFWS 2002, Larned 2006). Many of the birds disperse to the Aleutian Islands, the southern 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 western side, and near Ninilchik on the east (NOAA 2002, Larned 2006).

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

9.1.2.2 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 59195), respectively.

9.1.2.3 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 MBTA.

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 (NOAA 2002).

By September, seabird densities begin to decline as the birds leave nesting colonies for open marine waters, where they spend the winter (BOEM 2012a). Migration of waterfowl and shorebirds is more protracted in the fall than in the spring, and some shorebird species could 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 (BOEM 2012a). 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).

9.1.2.4 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 are listed and briefly described in **Table C-15**.

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.

9.2 GULF OF MEXICO PROGRAM AREA

The northern GOM 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 GOM 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 GOM to overwinter. Of the > 400 species of birds that have been reported in the northern GOM, many of these species occur in terrestrial habitats and are not likely to occur in marine and coastal habitats where they might 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 wading/marsh birds (**Table C-11**). Seabirds, waterfowl, shorebirds, and wading/marsh 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 GOM. A discussion of the listed species and their status is provided below, followed by a discussion of species that are not listed.

Table C-11. Examples of 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
Wading/marsh birds	Ciconiiformes	Egrets, herons, storks, ibises, and spoonbills
	Gruiformes	Cranes and rails

9.2.1 *Listed Species*

Under the ESA, there are seven threatened or endangered species of birds present in the northern GOM region that are considered and analyzed per consultation with USFWS: 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 73706), 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 might be affected by OCS oil and gas activities, and three species are exclusive to Florida, adjacent to the Eastern Planning Area, where they might 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 (USFWS 1999b), and is not expected to occur in areas where it might 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 GOM. 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 GOM. 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-12**) (USFWS 1999b). 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 (USFWS 1999b). 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-12**).

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 (USFWS 2014d). 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 southeastern Mississippi’s Jackson County (**Figure C-13**). The population is thought to consist of approximately 110 individuals, including approximately 20 to 25 breeding pairs (USFWS 2009b). 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 (USFWS 2009b).

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 (USFWS 2011a). Piping plover are very sensitive to human activities, and disturbances from anthropogenic activities can cause parents to abandon their nests (USFWS 2009c).

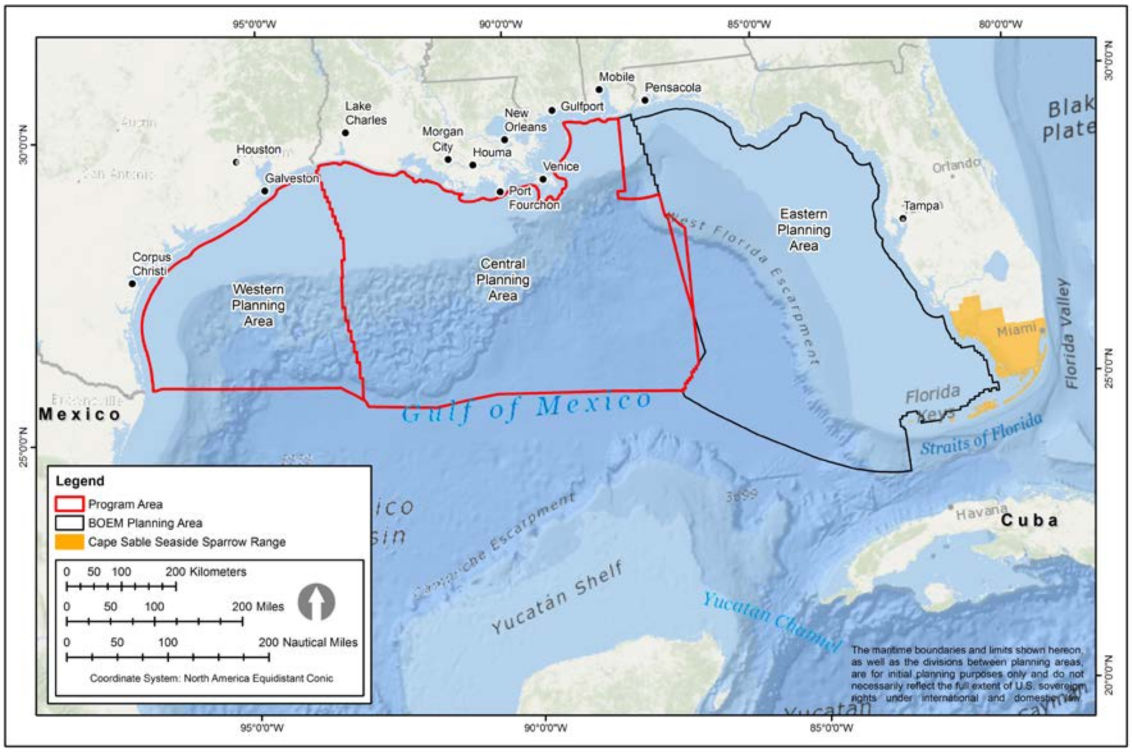


Figure C-12. Distribution of the Cape Sable Seaside Sparrow in the Gulf of Mexico Region

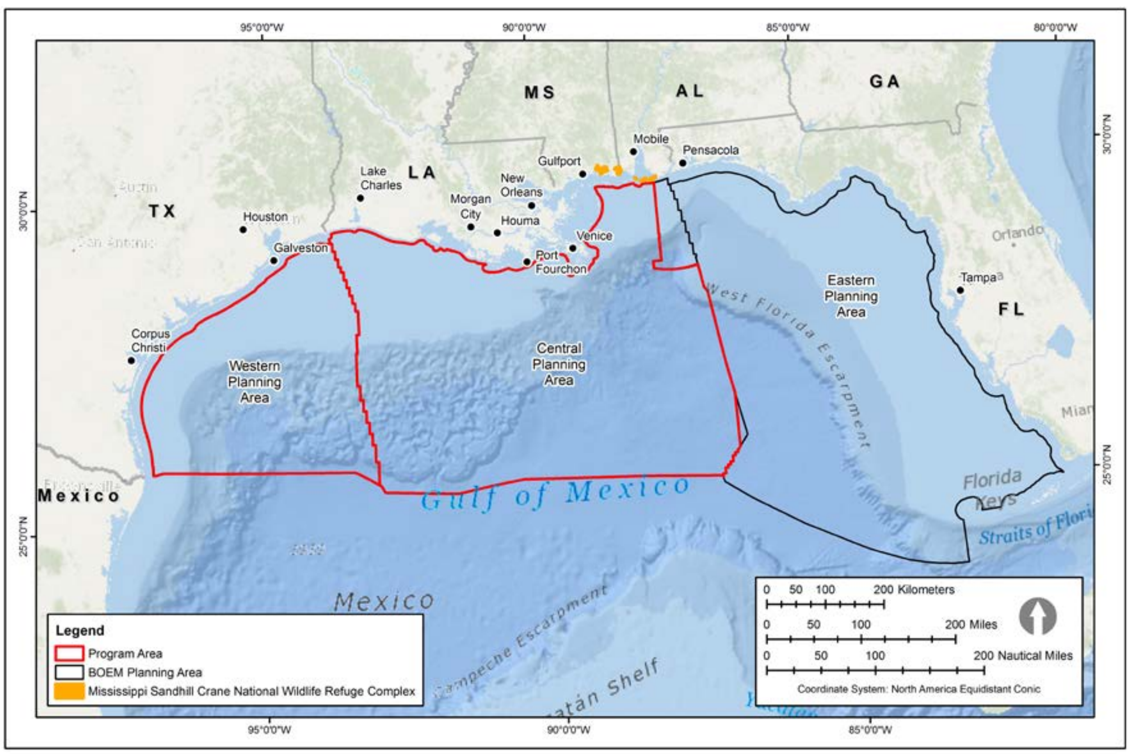


Figure C-13. Mississippi Sandhill Crane National Wildlife Refuge in the Gulf of Mexico Region

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 GOM 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 GOM 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 (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 GOM 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 western 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-14**). Thirty-three percent of these designated critical habitat areas are used by the Great Lakes breeding population of piping plovers (Stucker and Cuthbert 2006).

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 Tierra del Fuego, South America. Smaller populations winter in northeastern 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. 2001a, 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 GOM states (**Figure C-15**). They also use mangrove and brackish lagoons in Florida, and beaches, oyster reefs, and exposed bay bottoms in Texas (USFWS 2013a).

The red knot was added to the list of threatened species under the ESA (79 FR 73706) in December 2014 and the rule 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, 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, 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.

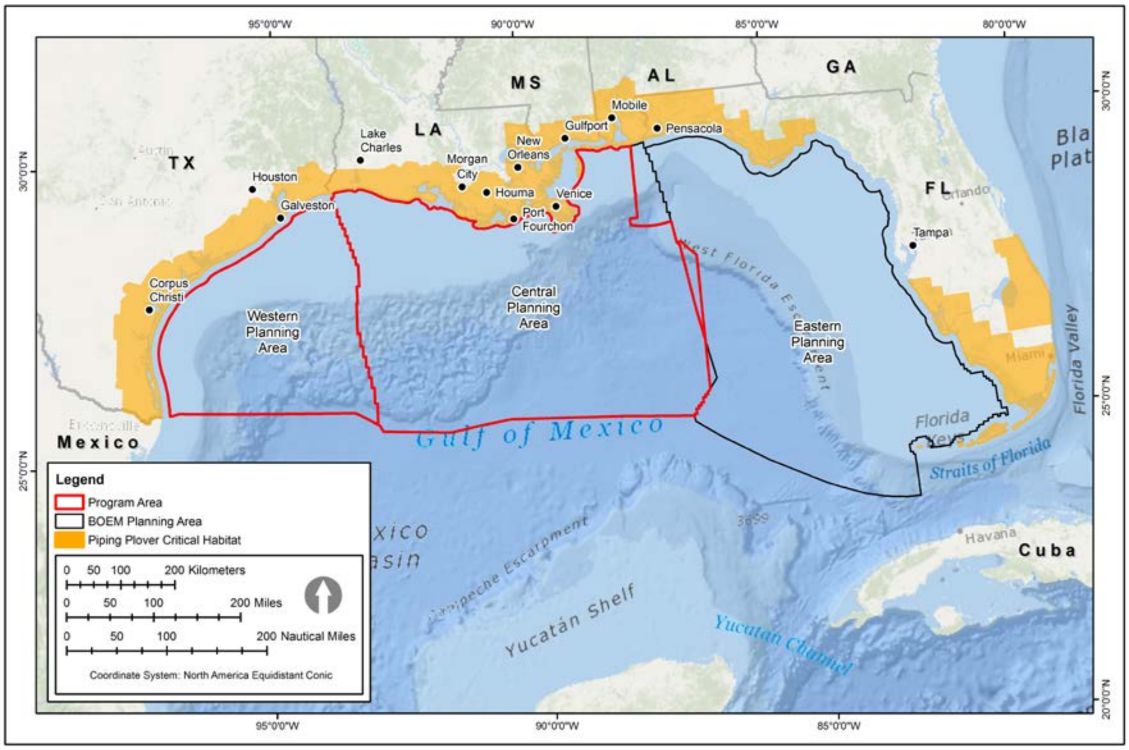


Figure C-14. Critical Habitat for the Piping Plover in the Gulf of Mexico Region

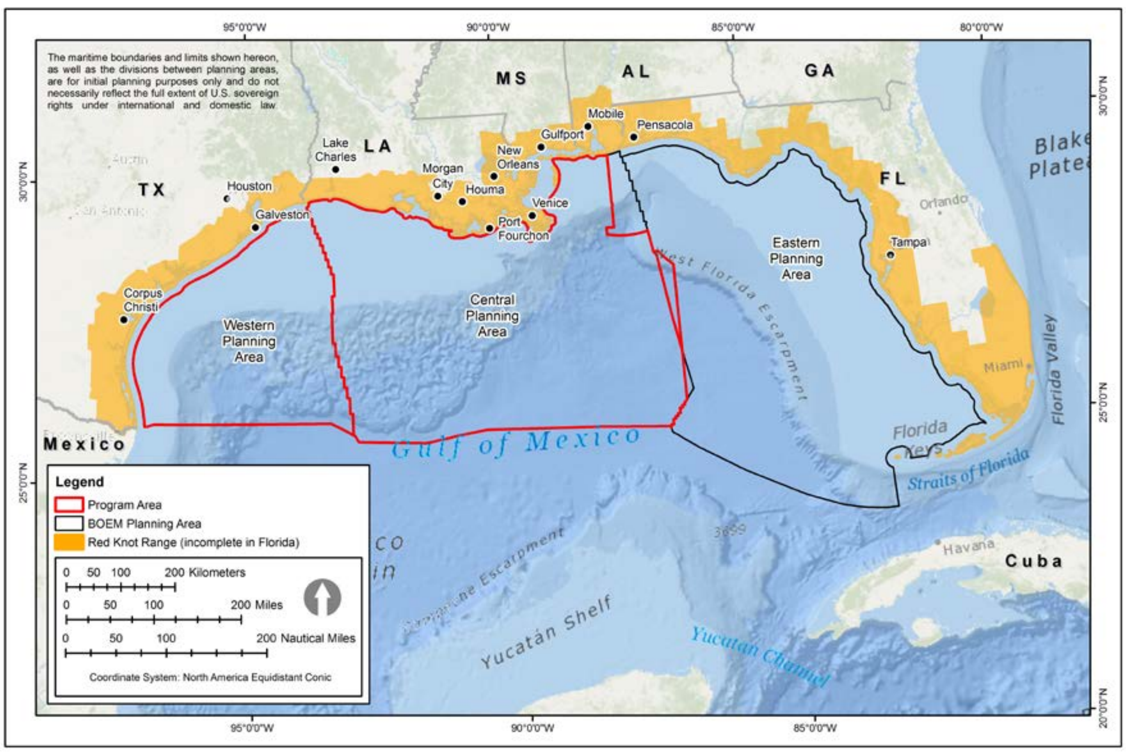


Figure C-15. Threatened Populations of the Red Knot in the Gulf of Mexico Region

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 (USFWS 2011c).

The roseate tern is a worldwide species that is divided into five subspecies, and only *S. dougallii* is located in the GOM region. The northeastern roseate tern population is thought to migrate through the eastern Caribbean and along the northern coast of South America, to winter mainly on the Atlantic coast of Brazil (USFWS 2010c). 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 (USFWS 2011d) (**Figure C-16**). 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 (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.

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 (USFWS 2014e). Four populations have been designated as nonessential experimental populations, and three occur in four of the GOM states (Florida, Alabama, Mississippi, and Louisiana) while the fourth is entirely outside the GOM. The Aransas NWR has been designated critical habitat for the whooping crane (43 FR 36588). See **Figure C-17**.

The whooping crane currently is listed as endangered over its entire range, except where listed as an experimental population. 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 (USFWS 2014e).

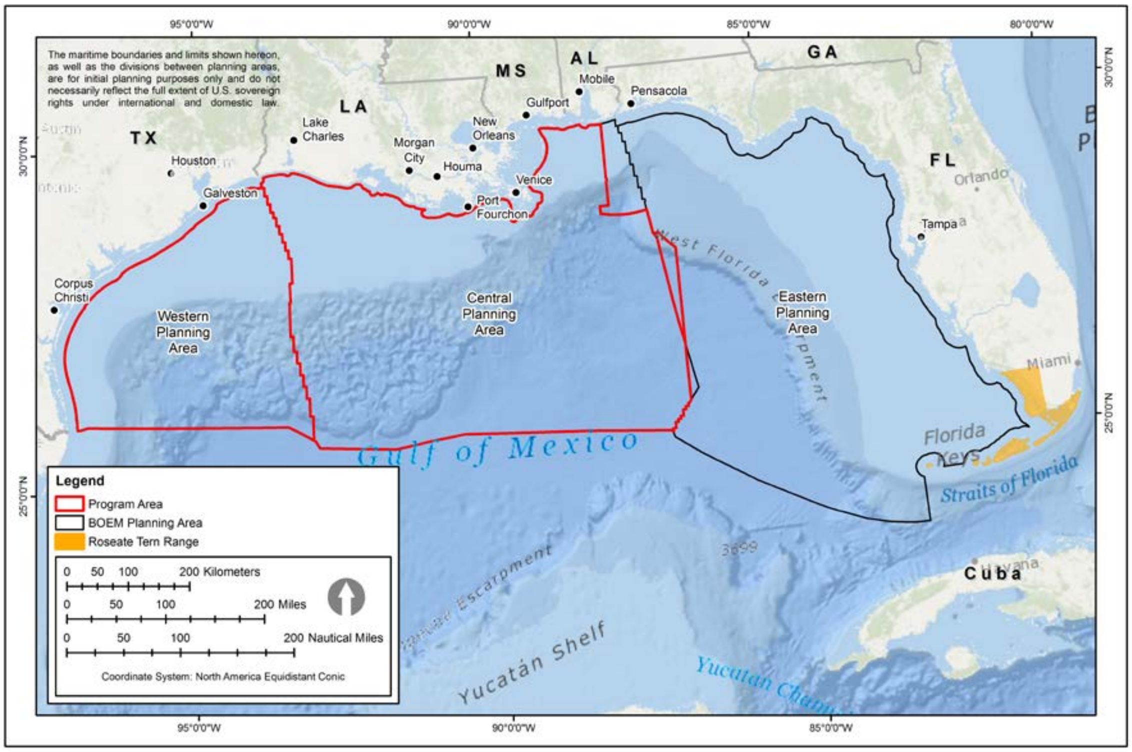


Figure C-16. Threatened Populations of the Roseate Tern in the Gulf of Mexico Region

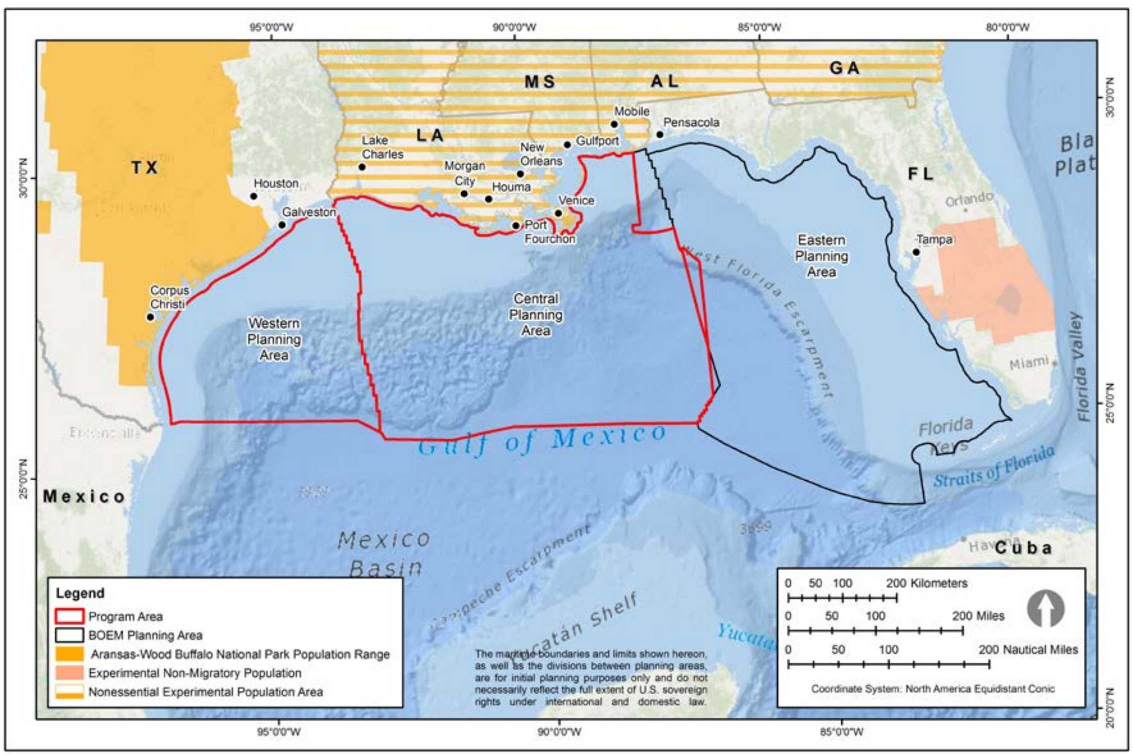


Figure C-17. Endangered and Experimental Populations of the Whooping Crane in the Gulf of Mexico Region

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 wading/marsh 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-18**). 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 37078). The decline of the wood stork has been attributed to a reduction in its food base due to a loss of wetland habitat in southern Florida (USFWS 2015e). No critical habitat has been designated for the wood stork.

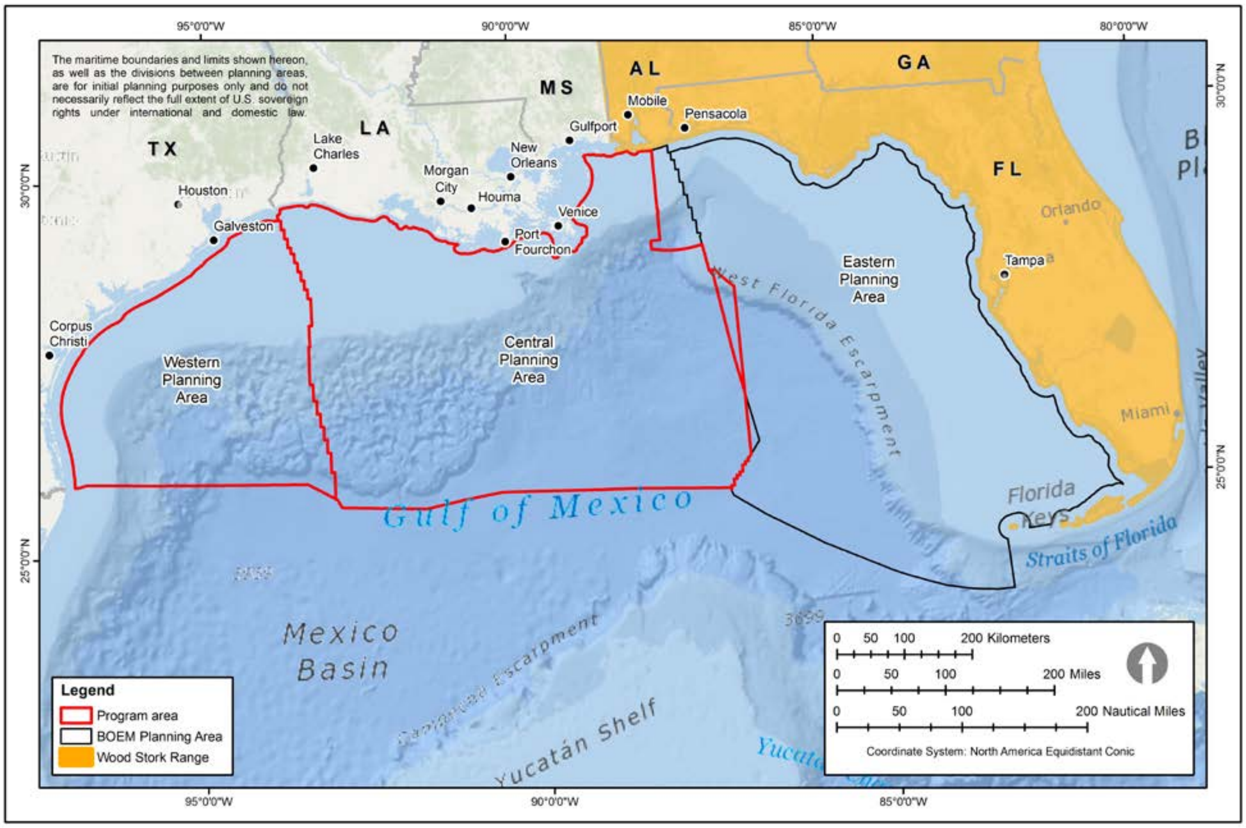


Figure C-18. Threatened Populations of the Wood Stork in the Gulf of Mexico Region

The wood stork nests primarily in cypress or mangrove swamps, and feeds in freshwater marshes, narrow tidal creeks, or flooded tidal pools (USFWS 2015e). 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 (USFWS 2015e). 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.

9.2.2 *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 GOM.

9.2.3 *Non-Listed Species of Birds*

Within the GOM, there are both resident and migratory bird species. Resident species are present throughout the year. Migratory species could be present only during breeding and wintering seasons, or they could only migrate through the GOM 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 GOM en route to breeding habitats in the U.S. and Canada from their wintering sites in the neotropics: southern 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 GOM.

The > 600 species of birds present within and adjacent to the GOM Planning Areas include passerines and near-passerine species such as the belted kingfisher (*Megaceryle alcyon*), raptors, seabirds, waterfowl, shorebirds, and wading/marsh birds (**Table C-16**). 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 would 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 GOM supports a wide diversity of year-round resident passerine and near-passerine species. Many others are winter residents that move south into the GOM 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 could forage in coastal freshwater and saltwater habitats. Bald eagles and ospreys are present throughout the year in the GOM.

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 GOM include members of five taxonomic orders (**Table C-12**): 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 GOM during their annual life cycles. Many species are present throughout the three GOM Planning Areas. Other species are present in only portions of the GOM (Peterson 1980, Clapp et al. 1982a, Clapp et al. 1982b, Clapp et al. 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.

Seabirds within the northern GOM 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 GOM: 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 GOM 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 could 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 could occur within coastal and inshore waters of the northern GOM include species within the subfamilies Aythyinae (diving ducks) and Merginae (sea ducks) of the Anseriformes Order (Sibley 2000) (**Table C-12**). 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 could occur within the northern GOM based on diving duck habitat. Members of the order Gaviiformes (loons) also could 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 could 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 in bays and estuaries, which are outside of the GOM Planning Areas; they might be affected by an accidental event but not by normal OCS oil and gas operations.

Table C-12. 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.

Order	Family	General Ecology	General Distribution/Migration
	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 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 environments 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.

Order	Family	General Ecology	General Distribution/Migration
	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 southwestern 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.

Sources: Peterson (1980), Harrison (1983, 1987), Sibley (2000), Morrison et al. (2001a), NatureServe (2015)
Key: GOM = Gulf of Mexico

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 GOM are included within the Order Charadriiformes (along with gulls and terns) (**Table C-12**) 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 GOM. 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 GOM (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 GOM (Morrison et al. 2001b, Morrison et al. 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 could also alter prevailing wind patterns that could affect ocean upwelling and productivity, in turn affecting shorebird abundance and distribution (Morrison et al. 2001b).

The Lower Mississippi and western coast of the GOM is rich with a variety of shorebird habitats and the GOM coast has some of the most important shorebird habitat in North America, particularly the Laguna Madre ecosystem along the southern Texas coast (Brown et al. 2001, Withers 2002). Resident shorebirds primarily rely on the shorelines adjacent to the GOM Program Area for their life functions; however, some shorebird species cross the GOM during their annual migration.

Wading/marsh birds

The wading/marsh 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 GOM, 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 grebes. Most wading/marsh birds are year-round residents of GOM coastal areas. Wading/marsh birds feed on primarily fish and invertebrates (Sibley 2000) and are susceptible when their habitats are disturbed, degraded, or lost.

9.2.4 *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 MBTA. Migratory movements of most 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. 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 (USFWS 2013b), which runs through the peninsula of southern Ontario across several states to the mouth of the Mississippi River. Many birds, as well as terrestrial bird species migrating to the tropics, follow the Mississippi Flyway and take a short cut across the GOM (USFWS 2013b). 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 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).

9.2.5 *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 (Audubon Society 2013), 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
- 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 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. The Audubon Society has identified 71 IBAs along the coast of the GOM that might interact with OCS oil and gas activities in the GOM (Audubon Society 2010). These include 17 sites in Texas, 7 in Louisiana, 7 in Mississippi, 4 in Alabama, and 36 in Florida (**Figure C-19**).

IBA sites along the GOM provide important overwintering habitat for some species, as well as important migration stopovers for land birds. A large variety of waterfowl, shorebirds, wading/marsh birds, and migrating passerines forage and rest in IBA habitats. Additionally, IBAs are important breeding grounds for shorebirds.

Furthermore, the GOM includes NWRs 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 (USFWS 2014f).

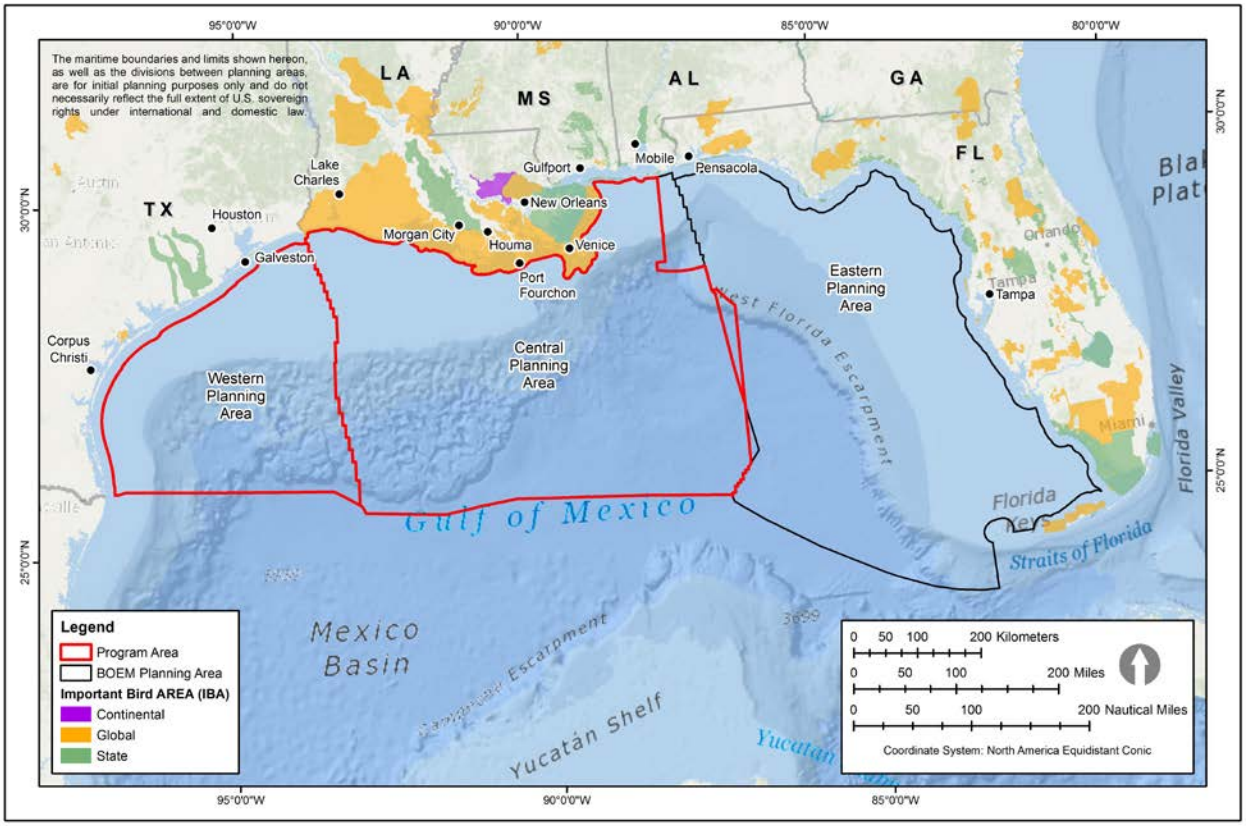


Figure C-19. National Audubon Society's Important Bird Areas in the Southeastern U.S.

10. MANAGED AND LISTED FISH SPECIES 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 Fishery Mangement Plans (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.

10.1 ALASKA PROGRAM AREAS

10.1.1 *Managed Species and Essential Fish Habitat*

10.1.1.1 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 (NPFMC 2009)
- FMP for the Salmon Fisheries in the EEZ off Alaska (NPFMC 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 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). Within the Arctic FMP, EFH has been designated for various stages of the three species listed below in **Table C-13** (NPFMC 2009).

Arctic Cod (*Boreogadus saida*)

The FMPs for Arctic cod have not been updated since the release of the 2012–2017 Programmatic EIS (BOEM 2012a) 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). Arctic cod, as was stated in the 2012–2017 Programmatic EIS, have been reported to spawn under ice during winter (Parker Stetter et al. 2011, BOEM 2012a).

Saffron Cod (*Eleginus gracilis*)

The FMPs for saffron cod have not been updated since the release of the 2012–2017 Programmatic EIS (BOEM 2012a) 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), wherever there are sand and gravel substrates.

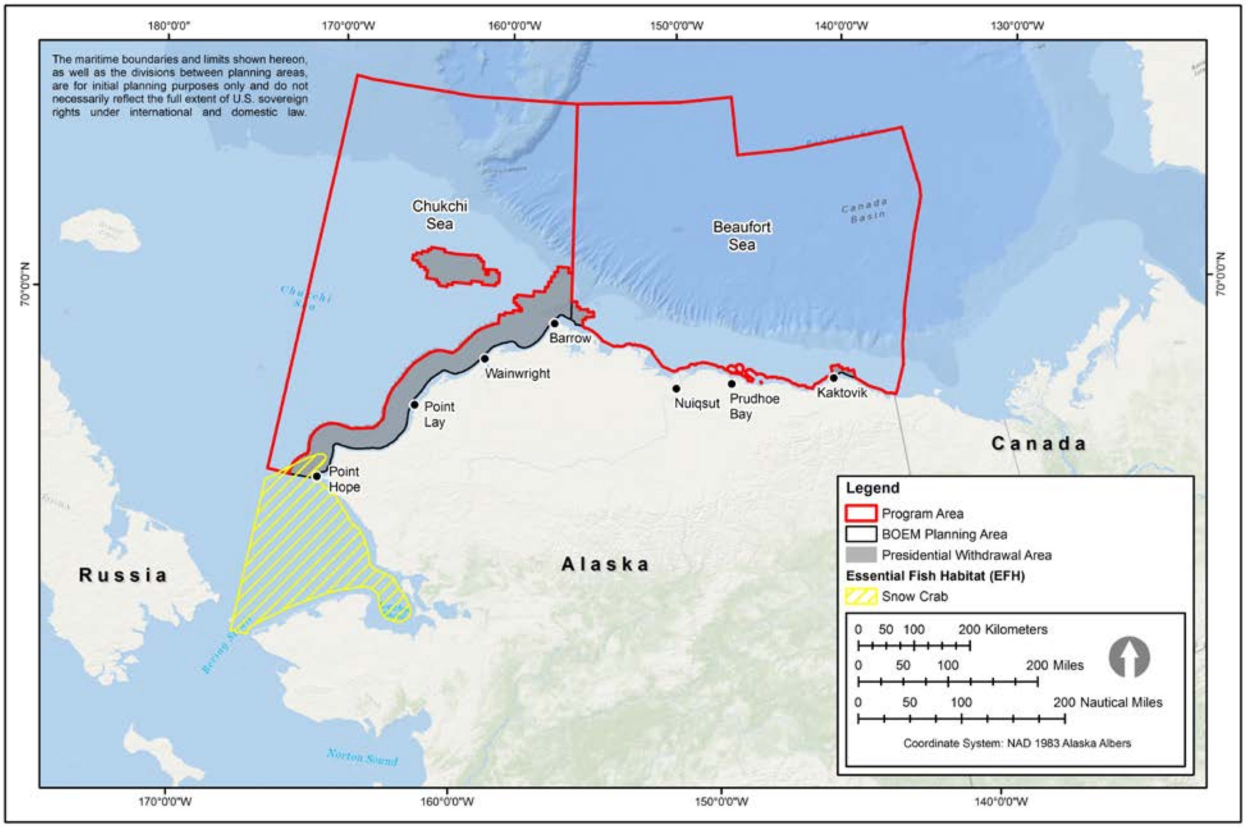
Table C-13. EFH by Life Stage for Arctic Cod, Saffron Cod, and Snow Crab

Species	Eggs	Larvae	Juveniles	Adults
Arctic cod (*Boreogadus saida*)	N/A	N/A	Pelagic and epipelagic waters from the nearshore to offshore areas along the entire shelf (0 to 200 m) and upper slope (200 to 500 m) throughout Arctic waters and often associated with ice floes, which could occur in deeper waters.	Pelagic and epipelagic waters from the nearshore to offshore areas along the entire shelf (0 to 200 m) and upper slope (200 to 500 m) throughout Arctic waters and often associated with ice floes, which could occur in deeper waters.
Saffron cod (*Eleginus gracilis*)	N/A	N/A	Pelagic and epipelagic waters along the coastline, within nearshore bays, and under ice along the inner (0 to 50 m) shelf throughout Arctic waters and wherever there are substrates consisting of sand and gravel.	Pelagic and epipelagic waters along the coastline, within nearshore bays, and under ice along the inner (0 to 50 m) shelf throughout Arctic waters and wherever there are substrates consisting of sand and gravel.
Snow crab (*Chionoecetes opilio*)	Essential fish habitat of snow crab eggs is inferred from the general distribution of egg-bearing female crab (see Adults).	N/A	Bottom habitats along the inner (0 to 50 m) and middle (50 to 100 m) shelf in Arctic waters south of Cape Lisburne, wherever there are substrates consisting mainly of mud.	Bottom habitats along the inner (0 to 50 m) and middle (50 to 100 m) shelf in Arctic waters south of Cape Lisburne, wherever there are substrates consisting mainly of mud.

Source: NPFMC 2015a

Snow Crab (*Chionoecetes opilio*)

The defined EFH for snow crab is shown in **Figure C-20**. 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.



Source: NPFMC 2014

Figure C-20. EFH for Snow Crab within the Bering Strait and Chukchi Sea

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 Seas (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, Logerwell et al. 2015). 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 (BOEM 2012a). Commercial fishing of 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, BOEM 2012a) 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 native to the Mackenzie River and consistently found there in low numbers (Irvine et al. 2009). Chum and pink salmon could be native to other rivers on the North Slope; that possibility has not been confirmed (Irvine et al. 2009).

10.1.1.2 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 (2010) 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 (NMFS 2015h). A list of the FMPs applicable to Cook Inlet is listed below:

- Gulf of Alaska (GOA) Groundfish FMP (NPFMC 2015b)
- Scallop FMP (NPFMC 2014)
- Salmon FMP (NPFMC 2012).

The GOA Groundfish FMP (NPFMC 2015b) pertains to the area depicted in **Figure C-21**, 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. 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 2015b). 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 2015b). Species taken within the groundfish fishery are broken into two main categories, Target Species and Ecosystem Components by the GOAFMP (NPFMC 2015b), and are presented and identified in the following categories:

Target Species:

Target species are 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. Target species are listed in **Table C-14**.

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. Pacific halibut (*Hippoglossus stenolepis*), Pacific herring (*Clupeus pallasii*), Pacific salmon (*Oncorhynchus* spp), steelhead trout (*Oncorhynchus mykiss*), king crab (*Paralithodes camtschaticus*), and tanner crab (*Chionoecetes bairdi*).

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. Forage species include smelts (Osmeridae), lanternfishes (Myctophidae), deep-sea smelts (Bathylagidae), sand lances (Ammodytidae), Pacific sand fishes (Trichodontidae), gunnels (Pholidae), warbonnents (Stichaeidae), bristlemouths (Gonostomatidae), and krill (Euphausiacea).

EFH has been designated for almost all of the life stages for managed species. Habitats utilized by the groundfish target species are listed in **Table C-20** (NPFMC 2015b). 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 are the rockfishes. This species group is represented by 39 species (Enticknap and Sheard 2005). Most of the rockfish use one or more of the habitats within the Cook Inlet during some stage of their lifecycle; 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 2015b). Within the Cook Inlet, non-pelagic trawling is prohibited by the GOAFMP in Federal waters and by the ADF&G in state waters.

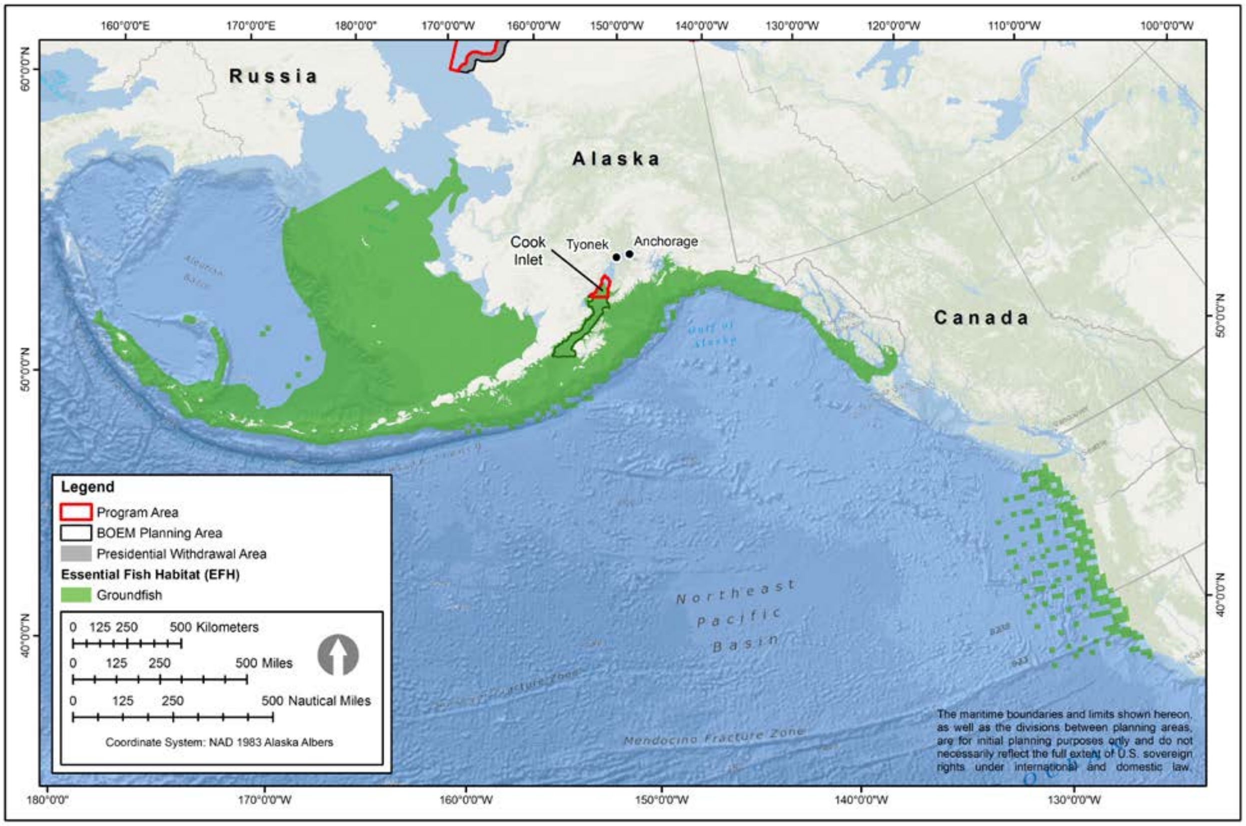


Figure C-21. EFH for the Species of Groundfish Commercially Harvested within the Gulf of Alaska

Table C-14. EFH by Life Stage for Target Groundfish Species in the Gulf of Alaska

Species	Eggs	Larvae	Juveniles	Adults
Walleye pollack (*Theragra calcogramma*)	Pelagic waters along the entire shelf (0 to 200 m), upper slope (200 to 500 m), and intermediate slope (500 to 1,000 m) throughout the GOA.	Epipelagic waters along the entire shelf (0 to 200 m), upper slope (200 to 500 m), and intermediate slope (500 to 1,000 m) throughout the GOA.	Lower and middle portion of the water column along the inner (0 to 50 m), middle (50 to 100 m), and outer (100 to 200 m) shelf throughout the GOA.	Lower and middle portion of the water column along the entire shelf (~10 to 200 m) and slope (200 to 1,000 m) throughout the GOA.
Pacific cod (*Gadus macrocephalus*)	Pelagic waters along the entire shelf (0 to 200 m) and upper (200 to 500 m) slope throughout the GOA wherever there are soft substrates consisting of mud and sand.	Pelagic waters along the inner (0 to 50 m) and middle (50 to 100 m) shelf throughout the GOA wherever there are soft substrates consisting of mud and sand.	Lower portion of the water column along the inner (0 to 50 m), middle (50 to 100 m), and outer (100 to 200 m) shelf throughout the BSAI wherever there are soft substrates consisting of sand, mud, sandy mud, and muddy sand.	Lower portion of the water column along the inner (0 to 50 m), middle (50 to 100 m), and outer (100 to 200 m) shelf throughout the GOA wherever there are soft substrates consisting of sand, mud, sandy mud, muddy sand, and gravel.
Sablefish (*Anoplopoma fimbria*)	Deeper waters along the slope (200 to 3,000 m) throughout the GOA.	Epipelagic waters along the middle shelf (50 to 100 m), outer shelf (100 to 200 m), and slope (200 to 3,000 m) throughout the GOA.	Lower portion of the water column, varied habitats, generally softer substrates, and deep shelf gulleys along the slope (200 to 1,000 m) throughout the GOA.	Lower portion of the water column, varied habitats, generally softer substrates, and deep shelf gulleys along the slope (200 to 1,000 m) throughout the GOA.
Yellowfin sole (*Limanda aspera*)	Pelagic waters along the entire shelf (0 to 200 m) and upper (200 to 500 m) slope throughout the GOA.	Located in pelagic waters along the shelf (0 to 200 m) and upper slope (200 to 500 m) throughout the GOA.	Lower portion of the water column within nearshore bays and along the inner (0 to 50 m), middle (50 to 100 m), and outer (100 to 200 m) shelf throughout the GOA wherever there are soft substrates consisting mainly of sand.	Lower portion of the water column within nearshore bays and along the inner (0 to 50 m), middle (50 to 100 m), and outer (100 to 200 m) shelf throughout the GOA wherever there are soft substrates consisting mainly of sand.
Northern rock sole (*Lepidopsetta polyxystra*)	N/A	Pelagic waters along the entire shelf (0 to 200 m) and upper slope (200 to 1,000 m) throughout the GOA.	Lower portion of the water column along the inner (0 to 50 m), middle (50 to 100 m), and outer (100 to 200 m) shelf throughout the BSAI wherever there are softer substrates consisting of sand, gravel, and cobble.	Lower portion of the water column along the inner (0 to 50 m), middle (50 to 100 m), and outer (100 to 200 m) shelf throughout the BSAI wherever there are softer substrates consisting of sand, gravel, and cobble.

Southern rock sole(*Lepidopsetta bilineata*)	N/A	Pelagic waters along the entire shelf (0 to 200 m) and upper slope (200 to 1,000 m) throughout the GOA.	Lower portion of the water column along the inner (0 to 50 m), middle (50 to 100 m), and outer (100 to 200 m) shelf throughout the GOA wherever there are softer substrates consisting of sand, gravel, and cobble.	Lower portion of the water column along the inner (0 to 50 m), middle (50 to 100 m), and outer (100 to 200 m) shelf throughout the GOA wherever there are softer substrates consisting of sand, gravel, and cobble.
Alaska Plaice(*Pleuronectes quadrituberculatus*)	Pelagic waters along the entire shelf (0 to 200 m) and upper slope (200 to 500 m) throughout the GOA in the spring.	Pelagic waters along the entire shelf (0 to 200 m) and upper slope (200 to 500 m) throughout the GOA.	Lower portion of the water column along the inner (0 to 50 m), middle (50 to 100 m), and outer (100 to 200 m) shelf throughout the BSAI wherever there are softer substrates consisting of sand and mud.	Lower portion of the water column along the inner (0 to 50 m), middle (50 to 100 m), and outer (100 to 200 m) shelf throughout the BSAI wherever there are softer substrates consisting of sand and mud.
Rex sole(*Glyptocephalus zachirus*)	Pelagic waters along the entire shelf (0 to 200 m) and upper slope (200 to 500 m) throughout the GOA in the spring.	Pelagic waters along the entire shelf (0 to 200 m) and upper slope (200 to 500 m) throughout the GOA.	Pelagic waters along the entire shelf (0 to 200 m) and upper slope (200 to 500 m) throughout the GOA.	Lower portion of the water column along the inner (0 to 50 m), middle (50 to 100 m), and outer (100 to 200 m) shelf throughout the GOA wherever there are substrates consisting of gravel, sand, and mud.
Dover sole (*Microstomus pacificus*)	Pelagic waters along the entire shelf (0 to 200 m) and slope (200 to 3,000 m) throughout the GOA.	Pelagic waters along the entire shelf (0 to 200 m) and slope (200 to 3,000 m) throughout the GOA.	Lower portion of the water column along the middle (50 to 100 m), and outer (100 to 200 m) shelf and upper slope (200 to 500 m) throughout the GOA wherever there are substrates consisting of sand and mud	Lower portion of the water column along the middle (50 to 100 m), and outer (100 to 200 m) shelf and upper slope (200 to 500 m) throughout the GOA wherever there are substrates consisting of sand and mud.
Flathead sole (*Hippoglossoides elassodon*)	Pelagic waters along the entire shelf (0 to 200 m) and slope (200 to 3,000 m) throughout the GOA	Pelagic waters along the entire shelf (0 to 200 m) and slope (200 to 3,000 m) throughout the GOA	Lower portion of the water column along the inner (0 to 50 m), middle (50 to 100 m), and outer (100 to 200 m) shelf throughout the GOA wherever there are softer substrates consisting of sand and mud	Lower portion of the water column along the inner (0 to 50 m), middle (50 to 100 m), and outer (100 to 200 m) shelf throughout the GOA wherever there are softer substrates consisting of sand and mud

Arrowtooth flounder (*Atheresthes stomias*)	N/A	Pelagic waters along the entire shelf (0 to 200 m) and slope (200 to 3,000 m) throughout the GOA	Lower portion of the water column along the inner (0 to 50 m), middle (50 to 100 m), and outer (100 to 200 m) shelf and upper slope (200 to 500 m) throughout the GOA wherever there are softer substrates consisting of gravel, sand, and mud	Lower portion of the water column along the inner (0 to 50), middle (50 to 100 m), and outer (100 to 200 m) shelf and upper slope (200 to 500 m) throughout the GOA wherever there are softer substrates consisting of gravel, sand, and mud
Pacific ocean perch (Sebastes alutus)	N/A	middle to lower portion of the water column along the inner shelf (0 to 50 m), middle shelf (50 to 100 m), outer shelf (100 to 200 m), and upper slope (200 to 500 m) throughout the GOA	middle to lower portion of the water column along the inner shelf (0 to 50 m), middle shelf (50 to 100 m), outer shelf (100 to 200 m), and upper slope (200 to 500 m) throughout the GOA wherever there are substrates consisting of cobble, gravel, mud, sandy mud, or muddy sand	Lower portion of the water column along the outer shelf (100 to 200 m) and upper slope (200 to 500 m) throughout the GOA wherever there are substrates consisting of cobble, gravel, mud, sandy mud, or muddy sand
Northern rockfish (*Sebastes polyspinis*)	N/A	N/A	N/A	Lower portions of the water column along the outer continental shelf (75 to 200 m) and upper slope (200 to 300 m) in the central and western GOA wherever there are substrates of cobble and rock
Shortraker rockfish(*Sebastes borealis*)	N/A	N/A	N/A	Lower portion of the water column along the upper slope (200 to 500 m) regions throughout the GOA wherever there are substrates consisting of mud, sand, sandy mud, muddy sand, rock, cobble, and gravel.
Rougheye (*Sebastes aleutianus*) and blackspotted rockfish (*Sebastes melanostictus*)	N/A	N/A	N/A	Lower portion of the water column along the outer shelf (100 to 200 m) and upper slope (200 to 500 m) regions throughout the GOA wherever there are substrates consisting of mud, sand, sandy mud, muddy sand, rock, cobble, and gravel

Dusky rockfish (*Sebastes variabilis*)	N/A	N/A	N/A	middle and lower portions of the water column along the outer shelf (100 to 200 m) and upper slope (200 to 500 m) throughout the GOA wherever there are substrates of cobble, rock, and gravel
Yelloweye rockfish (*Sebastes ruberrimus*)	N/A	Pelagic waters along the entire shelf (0 to 200 m) and slope (200 to 3,000 m) throughout the GOA	Lower portion of the water column within bays and island passages and along the inner (0 to 50 m), middle (50 to 100 m), and outer shelf (100 to 200 m) throughout the GOA wherever there are substrates of rock and in areas of vertical relief, such as crevices, overhangs, vertical walls, coral, and larger sponges	Lower portion of the water column within bays and island passages and along the inner shelf (0 to 50 m), middle shelf (50 to 100 m), outer shelf (100 to 200 m) and upper slope (200 to 500 m) throughout the GOA wherever there are substrates of rock and in areas of vertical relief, such as crevices, overhangs, vertical walls, coral, and larger sponges
Thornyhead rockfish (*Sebastolobus* spp.)	N/A	Pelagic waters along the entire shelf (0 to 200 m) and slope (200 to 3,000 m) throughout the GOA	Early juveniles: pelagic waters along the entire shelf (0 to 200 m) and slope (200 to 3,000 m) throughout the GOA; Late juveniles water column along the middle and outer shelf (50 to 200 m) and upper to lower slope (200 to 1,000 m) throughout the GOA wherever there are substrates of mud, sand, rock, sandy mud, muddy sand, cobble, and gravel	Lower portion of the water column along the middle and outer shelf (50 to 200 m) and upper to lower slope (200 to 1,000 m) throughout the GOA wherever there are substrates of mud, sand, rock, sandy mud, muddy sand, cobble, and gravel
Atka mackerel (*Pleurogrammus monopterygius*)	N/A	Epipelagic waters along the shelf (0 to 200 m), upper slope (200 to 500 m), and intermediate slope (500 to 1,000 m) throughout the GOA	N/A	Water column, from sea surface to the sea floor, along the inner (0 to 50 m), middle (50 to 100 m), and outer shelf (100 to 200 m) throughout the GOA wherever there are substrates of gravel and rock and in vegetated areas of kelp

Skates (Rajidae)	N/A	N/A	N/A	Lower portion of the water column on the shelf (0 to 200 m) and the upper slope (200 to 500 m) throughout the GOA wherever there are of substrates of mud, sand, gravel, and rock.
Squids (Cephalopoda, Teuthida)	N/A	N/A	Water column, from the sea surface to sea floor, along the inner (0 to 50 m), middle (50 to 100 m), and outer (200 to 500 m) shelf and the entire slope (500 to 1,000 m) throughout the GOA.	Lower portion of the water column along the inner (0 to 50 m), middle (50 to 100 m), outer shelf (100 to 200 m) and portions of the upper slope (200 to 500 m) throughout the GOA wherever there are substrates of rock, sand, mud, cobble, and sandy mud.

Source: NPFMC 2015b
Key: BSAI = Beaufort Sea/Aleutian Islands

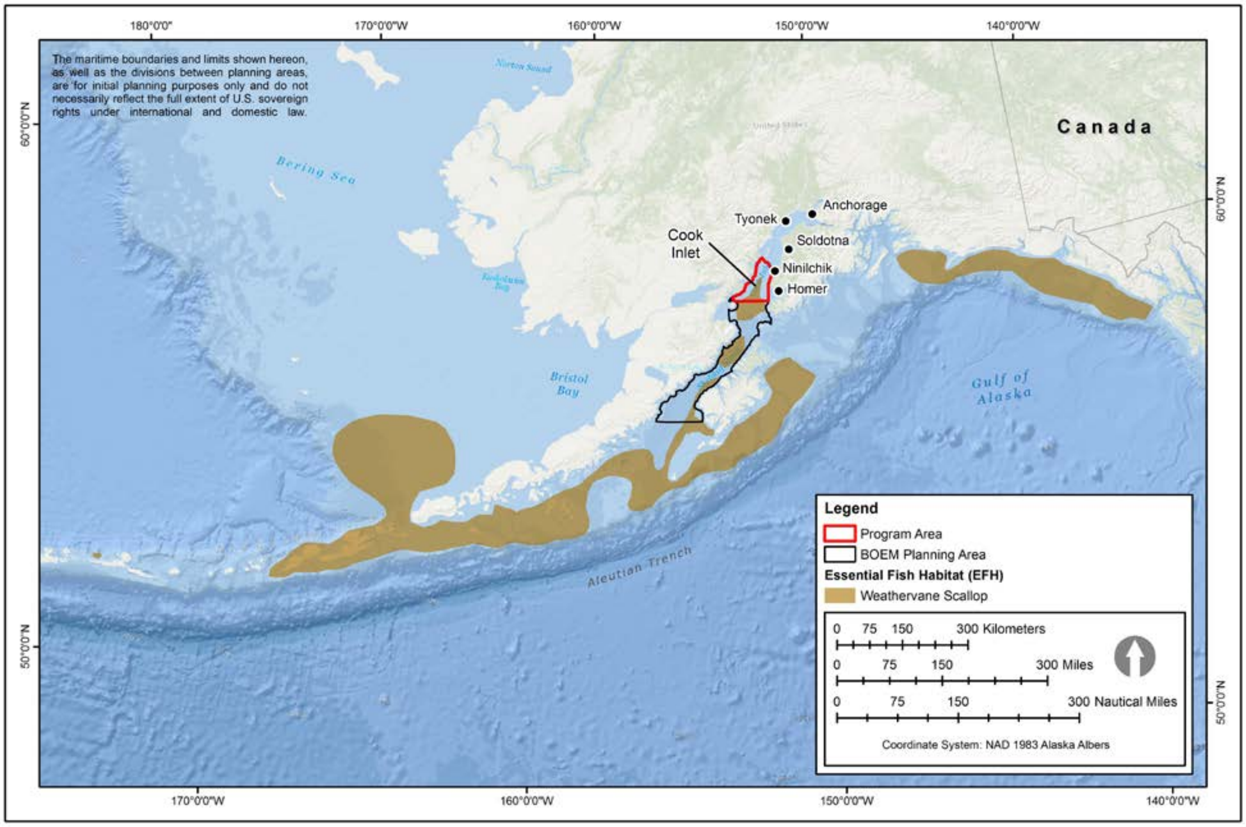
There are no HAPCs identified within Cook Inlet (NPFMC 2015c). The Alaska Seamount Habitat Protection Areas and Gulf of Alaska Coral Protection Areas are the closest designated HAPCs within the Alaskan EEZ and are approximately 416 km (225 nmi) from the entrance of Cook Inlet.

Within the benthic habitat of Cook Inlet, the only commercially targeted species is the weathervane scallop (*Patinopecten caurinus*). Its habitat, as defined in the 2014 Scallop FMP (NPFMC 2014), includes the Federal waters of the GOA, Aleutian Islands, the Bering Sea, and most specifically, within the lower portion of Cook Inlet (**Figure C-22**; 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*)
- Rock scallop (*Crassadoma gigantean*).

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 ADF&G 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-15). 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.



Source: NPFMC 2014

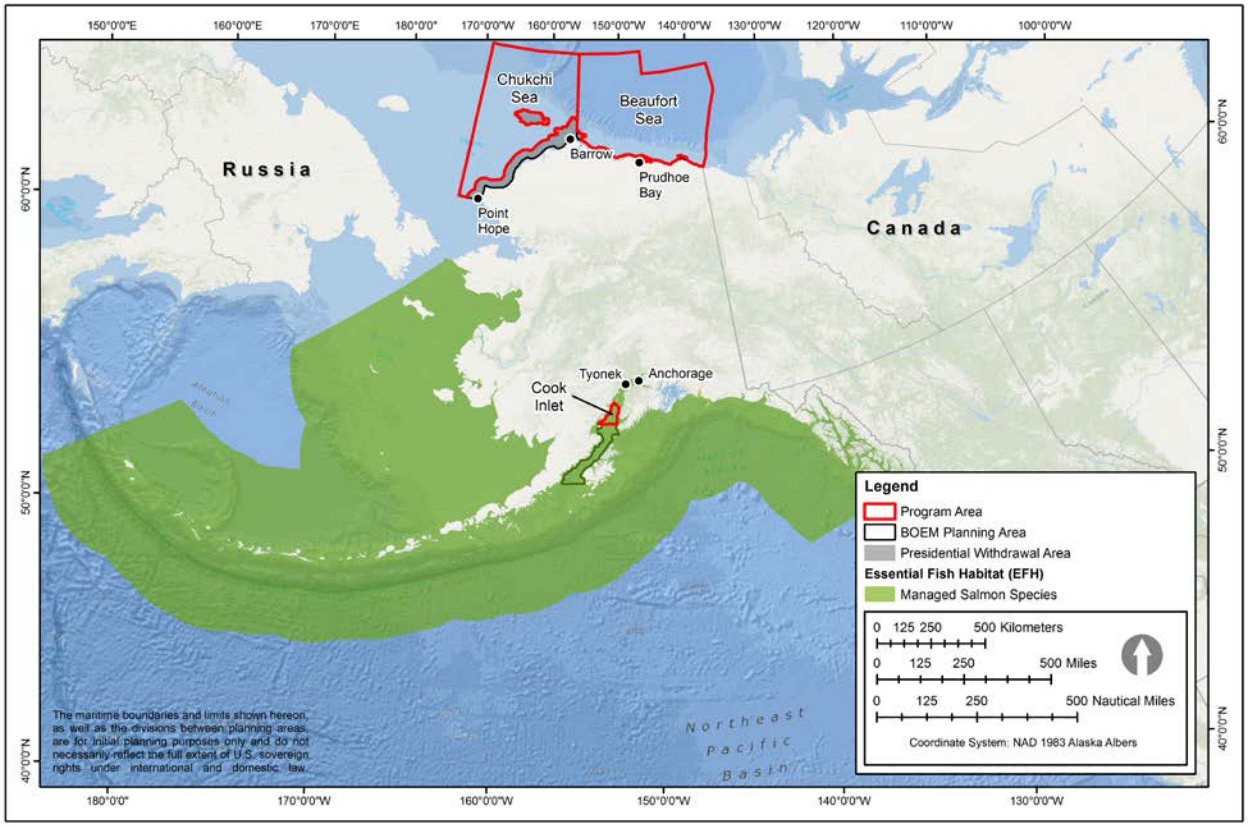
Figure C-22. EFH for the Weathervane Scallop within the Gulf of Alaska

Table C-15. EFH designation by Life Stage for Five Salmon Species (*Oncorhynchus* spp.)

Species	Egg and Larvae	Juveniles (freshwater)	Juveniles (estuarine)	Juveniles (marine)	Immature	Adult (freshwater)
Pink Salmon (*Onchorynchus gorbusch*a**)**	Intragravel; in stream beds; water courses, rivers streams, sloughs; lakes, ponds; beach (intertidal)	Rivers and streams; water courses, rivers streams, sloughs; lakes, ponds; beach (intertidal)	Estuarine, initially nearshore, then offshore in bays and inlets, along kelp beds	Coastal; inner, middle, and outer continental shelf; moving farther offshore with growth	Oceanic to nearshore in final migration	Water courses, rivers streams, sloughs; lakes, ponds; beach (intertidal)
Chinook Salmon **(***Oncorhynchus tshawytscha*)	Streambeds	Streams, sloughs, rivers	Beach (intertidal); nearshore bays	Island passés; inner/ middle/ outer continental shelf; upper slope; basin	Nearshore bays, island passés; inner/ middle/ outer continental shelf; upper slope; basin	Rivers, large streams and tributaries
Coho Salmon (*Oncorhynchus kisutch*)	Water courses, rivers, streams, sloughs; lakes, ponds	Water courses, rivers, streams, sloughs; lakes, ponds	Estuarine	Beach (intertidal), inner/ middle continental shelf; nearshore bays; island passes	Beach (intertidal), inner/ middle continental shelf; upper and lower slope; basin; nearshore bays; island passes	Water courses, rivers, streams, sloughs; lakes, ponds
Chum Salmon (*Oncorhynchus keta*)	Intragravel; in stream beds; water courses, rivers streams, sloughs; lakes, ponds; beach (intertidal)	Intragravel; in stream beds; water courses, rivers streams, sloughs; lakes, ponds; beach (intertidal)	Estuarine, initially nearshore, then offshore in bays and inlets, along kelp beds	Coastal; inner, middle, and outer continental shelf; moving farther offshore with growth	Oceanic to nearshore in final migration	Water courses, rivers streams, sloughs; lakes, ponds; beach (intertidal)
Sockeye Salmon (*Oncorhynchus nerka*)	Water courses, rivers streams, sloughs; lakes, ponds	Water courses, rivers streams, sloughs; lakes, ponds; estuarine	Beach (intertidal); estuarine, to 30 m	Beach (intertidal); inner and middle continental shelf; island passes; nearshore bays	Beach (intertidal), inner/ middle/ outer continental shelf, upper and lower slope; basin; island passes; nearshore bays	Water courses, rivers streams, sloughs; lakes, ponds

Source: NPFMC 2009

Figure C-23 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 ADF&G. No HAPC has been designated within Cook Inlet for salmon.



Source: NPFMC 2012

Figure C-23. EFH for the Five Managed Salmon Species in the EEZ off Alaska

10.1.2 *Listed Fishes*

There are no ESA-listed species in the Beaufort Sea and Chukchi Sea Program Areas.

10.2 GULF OF MEXICO PROGRAM AREA

10.2.1 *Managed Species and 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 six FMPs. The six FMPs manage 182 fishery species grouped as follows: reef fishes (31), coastal migratory pelagic fishes (3), red drum (*Sciaenops ocellatus*) (1), shrimp (4), spiny lobster (*Panulirus argus*) (1), and corals (142). The stone crab (*Menippe mercenaria*) was formerly managed by the GMFMC, but now is managed by the Florida Fish and Wildlife Conservation Commission (76 FR 59064) and will not be considered in this section. EFH for managed species 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 GOM are managed by the Highly Migratory Species Management Unit within the Office of Sustainable Fisheries under NMFS.

The aforementioned species all occur in the GOM for at least a portion of their lifecycles. The following sections (categorized by generalized habitat [hard bottom, soft bottom, or pelagic]) provides tables with that briefly describe EFH for groups of species such as reef fishes, coastal pelagic, and highly migratory species within the defined project area for all life stages as outlined by the management entities. Single species red drum, spiny lobster, and shrimps are not presented in this section. 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).

10.2.1.1 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-16**).

10.2.1.2 Pelagic Species

10.2.1.2.1 Coastal Pelagic Species

The coastal migratory pelagic fish unit, as defined by the GMFMC (1983) and SAFMC, includes three species representing two families: king mackerel (*Scomberomorus cavalla*) and Spanish mackerel (*S. maculatus*) in the Family Scombridae, and cobia (*Rachycentron canadum*) in the Family Rachycentridae (**Table C-17**).

Table C-16. Hard Bottom Species with EFH identified within the Gulf of Mexico

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 hard bottom	Spawn around hard bottom 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 *Sargassum* and flotsam	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 *Sargassum*, jellyfish, and flotsam	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- to 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

Family	Species	Eggs and Larvae	Juvenile	Adult	Spawning
	Mutton snapper (*Lutjanus analis*)	Shallow continental shelf waters	Shallow seagrass beds in tidal creeks and bights surrounded by mangroves, protected bays	Uncommon in GOM outside of southwestern Florda; offshore and nearshore 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 oil and gas platforms, 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
	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

Family	Species	Eggs and Larvae	Juvenile	Adult	Spawning
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	Uncommon in GOM outside of southwestern Florda; 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 hard bottom	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*)	Pelagic over shelf and coastal waters	Nearshore areas over vegetated sandy substrate, turtle grass *Thalassia* sp. beds and mangrove roots, and shallow reef areas	Uncommon in GOM outside of southwestern Florida shelf, 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

Family	Species	Eggs and Larvae	Juvenile	Adult	Spawning
	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
	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

Family	Species	Eggs and Larvae	Juvenile	Adult	Spawning
	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	Uncommon 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

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; rare in GOM outside of southwestern Florida	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	Inshore hard bottom and reefs, 12 to 33 m water depth	Campeche Bank, western 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 western Florida shelf

Family	Species	Eggs and Larvae	Juvenile	Adult	Spawning
	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

Source: Modified from GMFMC 2004
Key: GOM = Gulf of Mexico; N/A = not available

Table C-17. Coastal Migratory Pelagic Species and Life Stages with EFH

Species	Eggs and Larvae	Juvenile	Adult	Spawning/ Reproduction
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

Source: Modified from GMFMC 2004

10.2.1.3 Highly Migratory Species

There are 39 highly migratory species currently managed in the GOM 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 lifecycle within the GOM 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 within the GOM Program Area (**Table C-18**). **Table C-19** shows shark species with EFH in the GOM Program Area.

Table C-18. 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, farther 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

Species	Eggs and Larvae	Juvenile	Adult	Spawning/Reproduction
Blue marlin (*Makaira nigricans*)	Some larvae present in GOM	N/A	Epipelagic and oceanic	N/A
White marlin (*Tetrapturus albidus*)	N/A	Off the western 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 parts per thousand; 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.
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

Species	Eggs and Larvae	Juvenile	Adult	Spawning/Reproduction
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

Key: * = Species not managed in the Gulf of Mexico by NMFS; N/A = not available

Table C-19. Coastal Shark Species and Life Stages with EFH identified within the AOI

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
	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

Shark Group	Species	Neonates/Juvenile	Adult	Reproduction
	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

Shark Group	**Species**	**Neonates/Juvenile**	**Adult**	**Reproduction**
	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

Source: Modified from GMFMC 2004
Key: GOM = Gulf of Mexico; N/A = not available

10.2.2 ***Listed Fishes***

Two fish species listed under the ESA occur adjacent to but do not directly overlap the proposed GOM Area (**Figure C-24**). The smalltooth sawfish (*Pristis pectinata*) of the Family Pristidae are related to rays and is listed as endangered. Critical habitat has been described for smalltooth sawfish, but it is outside of the GOM Program Area. Gulf sturgeon (*Acipenser oxyrinchus desotoi*) is a member of Family Acipenseridae of the ray-finned fishes (Class Actinopterygii). This species, listed as threatened, has critical habitat designated in the GOM in nearshore and estuarine waters, as well as riverine systems adjacent to the GOM. No critical habitat falls within the GOM Program Area.

10.2.2.1 Smalltooth Sawfish (Pristis pectinata)

10.2.2.1.1 Distribution and Abundance

The historic range of smalltooth sawfish extended throughout the GOM 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 Distinct Population Segment (DPS) is surviving and reproducing in the waters of southwestern 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, NMFS 2009a). This area includes most of the critical habitat shown in **Figure C-24**. Since this species is found outside of the GOM 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 could 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 (NMFS 2009a).

10.2.2.1.2 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 (NMFS 2009a). 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 could be susceptible to predation from bull sharks (*Carcharhinus leucas*) and lemon sharks (*Negaprion brevirostris*) that inhabit similar water depths as the smalltooth sawfish (NMFS 2009a)

10.2.2.1.3 Status

In response to a petition from the Ocean Conservancy, NMFS conducted a status review of the smalltooth sawfish in 2000 (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 southwestern coast of Florida, in the eastern portion of the program area (**Figure C-24**). 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, NMFS 2009a).

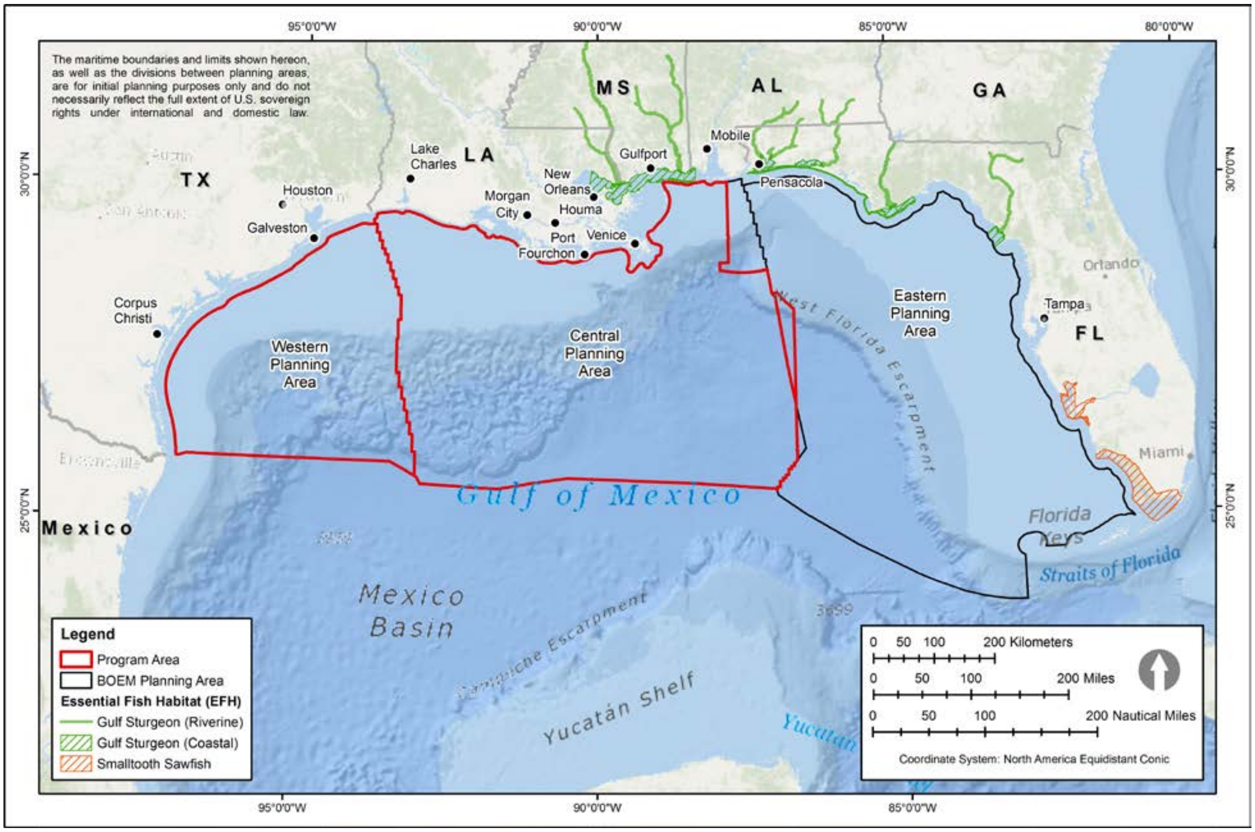


Figure C-24. Critical Habitat for Smalltooth Sawfish and Gulf Sturgeon in the Gulf of Mexico

10.2.2.2 Gulf Sturgeon (*Acipenser oxyrinchus desotoi*)

10.2.2.2.1 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 GOM from Lake Pontchartrain and the Mississippi River, east to Florida's Suwannee River, and in the central and eastern GOM 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).

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, USFWS and NMFS 2009).

10.2.2.2.2 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 behavioral significance of these sounds is generally unknown (Sulak et al. 2002).

Gulf sturgeon stop feeding while migrating upstream to spawn, so feeding primarily occurs while in the GOM during winter. Sturgeons are bottom suction feeders that have ventrally located, highly protrusible 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 chin barbels, like catfish. The barbels are also useful for navigation in high-order (i.e., larger) streams if visibility is low and at night.

10.2.2.2.3 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 (USFWS and GSMFC 1995). Critical habitat was designated on March 19, 2003 (68 FR 13370).

11. ARCTIC TERRESTRIAL WILDLIFE AND HABITAT

11.1 CARIBOU MIGRATION

Caribou migrate seasonally between their calving areas, summer range, and winter range to take advantage of seasonally available forage resources. If movements are greatly restricted, caribou are likely to overgraze their habitat, potentially leading to drastic, long-term population declines. The caribou diet shifts from season to season and depends on the availability of forage. In general, the winter diet of caribou has been characterized as consisting predominantly of lichens and mosses, with a shift to vascular plants during the spring (Thompson and McCourt 1981). However, when TCH caribou winter near Teshekpuk Lake, where relatively few lichens are present, this herd may consume more sedges and vascular plants.

Spring migration of parturient female caribou from the overwintering areas to the calving grounds starts in late March (Hemming 1971). Often the most direct routes are used; however, certain drainages and routes probably are used during calving migrations, because they tend to be the corridors free of snow or with shallow snow (Lent 1980). Bulls and nonparturient females generally migrate later. Severe weather and deep snow can delay spring migration, with some calving occurring en route (Carroll et al. 2005). Cows calving en route usually proceed to their traditional calving grounds (Hemming 1971).

Traditional calving grounds consistently provide high nutritional forage to lactating females during calving and nursing periods, which is critical for the growth and survival of newborn calves. Eriophorum-tussock-sedge buds (tussock cotton grass) appear to be very important in the diet of lactating caribou cows during the calving season (Lent 1966, Thompson and McCourt 1981, Eastland, Bowyer, and Fancy 1989), while orthophyll shrubs (especially willows) are the predominant forage during the postcalving period (Thompson and McCourt 1981). The availability of sedges during spring, which apparently depend on temperature and snow cover, probably affects specific calving locations and calving success.

The evolutionary significance of the establishment of the calving grounds may relate directly to the avoidance of predation on the caribou calves, particularly predation by wolves (Bergerud 1974, Bergerud 1987). Caribou calves are very vulnerable to wolf predation, as indicated by the documented account of surplus predation by wolves on newborn calves (Miller, Gunn, and Broughton 1985). By migrating north of the tree line, caribou leave the range of the wolf packs, which generally remain on the caribou winter range or in the mountain foothills or along the tree line during the wolf-pupping season (Heard and Williams 1991, Bergerud 1987). By calving on the open tundra, the cow caribou also avoid ambush by predators. The selection of snow-free patches of tundra on the calving grounds also helps to camouflage the newborn calf from other predators such as golden eagles (Bergerud 1987). However, the sequential spring migration, first by cows and later by bulls and the rest of the herd, is believed to be a strategy for optimizing the quality of forage as it becomes available with snowmelt on the arctic tundra (Whitten and Cameron 1980, Griffith et al. 2002). The earlier migration of parturient cow caribou to the calving grounds also could reduce forage competition with the rest of the herd during the calving season.

11.2 Caribou Calving Grounds

Calving takes place in the spring, generally from late May to late June (Hemming 1971). The WAH calving area is inland on the NPR-A. Typically, most pregnant cows reach the calving grounds by late May. Most give birth in the Utukok uplands during late May through early June. By mid-June large postcalving aggregations begin forming as cows with neonates move west toward the Lisburne Hills (Dau 2005). The TCH's central calving area generally is located on the east side of Teshekpuk Lake and near Cape Halkett, adjacent to Harrison Bay.

The CAH generally calves within 30 km of the Beaufort coast between the Itkillik and Canning rivers. The herd separates into two segments based on the locations of the calving concentration areas, one on each side of the Sagavanirktok River. Since 2004, the PCH has primarily calved in Ivvavik National Park, Canada. In 7 of 11 years during 2004–2014, PCH calving occurred on the coastal plain, primarily in Yukon between the Alaska-Canada border and the Babbage River. In the other 4 years, calving occurred in both Alaska and Canada, and some calving occurred in the 1002 area during 3 of those years (Harper and McCarthy 2015).

11.3 Caribou Summer and Insect Relief Areas

In the postcalving period (July through August), caribou attain their highest degree of aggregation. During calving and postcalving periods, cow/calf groups are most sensitive to human disturbance. They join into increasingly larger groups, foraging primarily on the emerging buds and leaves of willow shrubs and dwarf birch (Thompson and McCourt 1981). Members of the WAH may be found in continuous herds numbering in excess of tens of thousands of individuals, and portions of the WAH may be found throughout their summer range. Insect-relief areas become important during late June to mid-August during the insect season (Lawhead 1997). Insect harassment reduces foraging efficiency and increases physiological stress (Reimers 1980). For insect relief, caribou use various coastal and upland habitats such as sandbars, spits, river deltas, some barrier islands, mountain foothills, snow patches, and sand dunes, where stiff breezes prevent insects from concentrating and alighting on the caribou. It is common for members of the TCH to aggregate close to the coast for insect relief. Some small groups, however, gather in other cool, windy areas such as the Pik Dunes located about 30 km south of Teshekpuk Lake (Hemming 1971, Philo, Carroll, and Yokel 1993). Caribou aggregations move frequently from insect-relief areas along the arctic coast (the CAH, WAH, and especially the TCH) and in the mountain foothills (some aggregations of the WAH) to and from green foraging areas. While the pattern of habitat use can vary from year to year, members of the PCH generally spend the summer between the Canning River tothe west and can range east to both the Yukon Territory and western Northwest Territories both north south of the Brooks Range (Harper and McCarthy 2015).

11.4 Caribou Winter Range and Distribution

The WAH caribou generally reach their winter ranges in early to late November and remain on the range through March (Hemming 1971, Henshaw 1968). The primary winter range of the WAH is south of the Brooks Range along the northern fringe of the boreal forest. Since 1996, much of the WAH has shifted its winter range from the Nulato Hills to the eastern half of the Seward Peninsula, and has generally been more dispersed than prior to that time (Dau 2005). However, in recent winters, > 30,000 WAH caribou have wintered in the northwest portion of their range. During two of these winters (1994-1995 and 1999-2000) caribou wintering along the Chukchi Sea coast between Cape Lisburne and Cape Krusenstern experienced high, localized mortality. Investigation indicated that caribou in this area were malnourished (Dau 2005). During winters of heavy snowfall or severe ice crusting, caribou may overwinter within the mountains or on the Arctic Slope (Hemming 1971). Even during normal winters, some caribou of the WAH overwinter on the ACP. The TCH was believed to reside year-round in the Teshekpuk Lake area (Davis, Valkenburg, and Boertje 1982); however, satellite collar data from Teshekpuk Lake caribou indicate that some animals travel great distances to the south, as far as the Seward Peninsula (Carroll 1992). The CAH overwinters primarily in the northern foothills of the Brooks Range (Roby 1980). Between 2012 and 2014, common wintering areas for PCH are the Ogilive Mountains and Old Crow Flats in the Yukon Territory and the upper Chandalar River area of northeast Alaska (Harper and McCarthy 2015).

The movement and distribution of caribou over the winter ranges reflect their need to avoid predators and their response to wind (storm) and snow conditions (depth and snow density), which greatly influence the availability of winter forage (Henshaw 1968, Bergerud 1974, Bergerud and Elliot 1986). The numbers of caribou using a particular portion of the winter range are highly variable from year to year (Davis et al. 1982, Fancy et al. 1989 as cited in Whitten 1990). Range condition, distribution of preferred winter forage (particularly lichens), and predation pressure all affect winter distribution and movements (Roby 1980, Bergerud 1974).

12. ARCHAEOLOGICAL AND HISTORICAL RESOURCES

Cultural resources can be defined as the “broad array of stories, knowledge, people, places, structures, and objects, together with their associated environment, that contribute to the maintenance of cultural identity and/or reveal the historic and contemporary human interactions with an ecosystem” (Ball et al. 2015). This includes tangible heritage (e.g., historic structures, monuments, archaeological sites, artifacts) and intangible heritage (e.g., cultural and spiritual environment, community expressions, practices, and values, and cultural items) (Ball et al. 2015, King 2000). Information on cultural practices (e.g., the cultural significance of subsistence activities) can be found in the discussion on Sociocultural Systems (**Section 4.3.16** in the Programmatic EIS). For the following discussion, archaeological resources are defined as any material remains of human life or activities that are at least 50 years of age and are of archaeological interest (30 CFR 550.105). By the careful scientific study of archaeological sites, features, and artifacts, archaeologists are able to extract information such as past human behavior, cultural adaptation, and related topics.

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, or actions properties on or eligible to be on the National Register of Historic Places (*National Register*). The tenets of the Section 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. Significant archaeological resources are those that meet the criteria of significance and integrity for eligibility on the *National Register*, as defined in 36 CFR 60.4. Historical resources are a broader category that can include archaeological resources (if they pertain to the post-contact period), but for this analysis, are generally considered built structures or landscapes that meet the requirements of significance and integrity for eligibility on the *National Register*. 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 (Ball et al. 2015). BOEM and BSEE have published guidelines for performing archaeological surveys in the OCS (**Appendix I**).

12.1 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 years before present (B.P.) also could 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 could 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 include 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.

12.1.1 *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 (BOEM 2012a). Historic shipwrecks within the Alaska program areas date from the 18th century until modern times. Other resources that could be 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, 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 could 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 Mikkelsen and Leffingwell for providing transportation to Flaxman Island in the Beaufort Sea (Mikkelsen 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. Nine of these sites are in the Cook Inlet Planning Area and 184 are 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 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.

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 (BOEM 2012a). 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 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 waters off Alaska depends mainly on three factors: wave action/currents, ice, and temperature of the water column immediately above the seafloor. Wrecks 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 there have a greater potential for preservation. Findings from the “Jeremy Project”, however, indicate that the assumption of a low potential for archaeological resources in high-density ice gouging areas could be more apparent than real (BOEM 2014).

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 (BOEM 2014, 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, on the western side of the Cook Inlet Planning Area, have erupted more than once in historic times (Alaska Volcano Observatory 2014a, Alaska Volcano Observatory 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 (MMS 2003a, Vol. 1). Since the 1912 Novarupta eruption at Katmai, in the southwestern corner of the Cook Inlet Planning Area, sediment accumulation has ranged from approximately 8 cm in the northeastern part of the planning area to 84 cm in the central part (MMS 2003a, Vol. 1).

12.1.2 *Pre-contact Resources*

Submerged cultural resources also include pre-contact archaeological sites. At the height of the Late Wisconsin glacial period (approximately 19,000 years 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 years B.P. When Alaska was first populated approximately 14,800 years 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 that could or could 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 could 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 could have removed archaeological evidence.

Since 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, BOEM 2014, 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 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 (MMS 2003a, Vol. 1). The impacts of these environmental conditions are greatly reduced in the deeper waters of the OCS and landforms there have a greater potential for preservation. The seafloor of lower Cook Inlet is characterized by lag gravels, sand ribbons, and sand wave fields (MMS 2003a, Vol. 1). These features are formed only in high-energy areas, and currents in the area could have removed archaeological evidence through scour and erosion (MMS 1995, Vol. 2; MMS 2003a, Vol. 1).

Volcanic activity could 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 (MMS 2003a, Vol. 1).

Along the Arctic north coast, Holocene sediments are generally thin and composed of marine silts, clay, and fine-grained sands (MMS 2003b, Vol. 1). Lag gravels can be found in small patches just outside of the 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) (MMS 1990, Vol. 2).

12.2 GULF OF MEXICO PROGRAM AREA

Submerged cultural resources within the GOM 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 years B.P. also could be present within the GOM 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 GOM 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 economic exclusion zone (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 GOM Program Area.

12.2.1 *Historic Shipwrecks*

European explorers have been active in the GOM 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 GOM 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 GOM Program Area were estimated using information from various public and proprietary databases, and a variety of secondary sources with information about shipwrecks within the GOM 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 GOM 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 could be present asshipwrecks in the nearshore zone of the GOM 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 GOM Program Area with their locational information. 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 because there could 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 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 GOM 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 (BOEM 2012a, Vol. 2). Shipwrecks in areas with high sedimentation rates are expected to be better preserved. The western and central GOM, 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 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 GOM 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 GOM. 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, using 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 GOM 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 GOM 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) used 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 GOM. 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 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 surveys 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) (BOEM 2012a, Vol. 1). Nine of those potential sites have been visually confirmed as shipwrecks (BOEM 2012a, Vol. 1). BOEM currently recommends archaeological surveys for all new seafloor-disturbing activities.

12.2.2 *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 years B.P. and did not reach current stands until approximately 3,500 years B.P. (Pearson et al. 1986). Archaeological evidence indicates that the GOM region was occupied by pre-contact peoples as long ago as 12,000 years B.P. Sea level curves produced by 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 GOM Program Area, Holocene deposits are thicker in western 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 (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 years B.P. have been found along the current shoreline and are thought to have resulted from re-deposition of material from a now-submerged but eroding shoreline (Stright et al. 1999). 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 years 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 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 could 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 could indicate pre-Clovis occupation (Waters et al. 2011). Material from the site suggests occupation between 13,200 and 15,500 years 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 GOM 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 could be intact Paleo-Indian sites submerged along the GOM 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.

13. POPULATION, EMPLOYMENT, AND INCOME

Please see **Section 4.3.12** in the Programmatic EIS for a description of the affected environment for population, employment, and income.

14. LAND USE AND INFRASTRUCTURE

14.1 ALASKA PROGRAM AREA

14.1.1 *Beaufort Sea and Chukchi Sea Program Areas*

The Arctic region includes the Beaufort Sea and Chukchi Sea Program Areas (**Figure 2.1-1** in the Programmatic EIS). A majority of the North Slope oil and gas infrastructure is closer to the Beaufort Sea Program Area from existing operations at Prudhoe Bay, but limited infrastructure exists to support the full suite of OCS operations.

14.1.1.1 Land Use

Land use in much of the Arctic is primarily limited to subsistence pursuits, except for oil- and gas-related activities (**Section 14.1.1.3**). There are only a few small communities adjacent to these program 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 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 Program 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 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 (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.

14.1.1.2 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 in the NSB.

14.1.1.3 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 northeastern 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.

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 (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 could review projects that would impact a municipality under its jurisdiction. Comments or recommendations could 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 2011, Alaska Department of Commerce 2012).

14.1.1.4 U.S. Department of Defense and NASA Use Areas

The Beaufort Sea and Chukchi Sea Program 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 on the coast bordering the Beaufort Sea and Chukchi Sea Program 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 (BOEM 2012a).

14.1.2 *Cook Inlet Program 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 and Workforce Development 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.

14.1.2.1 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 Program 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.

In addition to tourism and recreation, the Cook Inlet Program 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 Program 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 Program 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.

14.1.2.2 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 on the eastern 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 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).

14.1.2.3 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 (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. The Cook Inlet Program Area has several hundred miles of undersea and onshore oil and gas pipelines. On state lands north of the Cook Inlet Program 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. 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 2014). This growth is attributed to increased investment by Cook Inlet independent oil producers, most notably Hilcorp Energy.

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.

Prior to 2009, crude oil production on the western side of Cook Inlet was transported by pipeline to the Drift River Tank Farm at the terminus of the Drift River. From there, crude oil was pumped via pipeline to a ship loading facility 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 western 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 and Conoco Phillips 2015).

14.1.2.4 U.S. Department of Defense 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 Program 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).

14.2 GULF OF MEXICO PROGRAM AREA

The GOM 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 GOM, and the region contains one of the five most populous U.S. cities, Houston (as of 2010; USCB 2012). Approximately 13 percent of the nation's coastal population (as of 2010; USCB 2011) and 10 of the nation's 20 largest ports by tonnage (as of 2013; AAPA 2013) are found in the GOM.

Given the size and unique ecological diversity of land adjacent to the GOM, 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 GOM participate in the national 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 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
- Coordinating state and federal actions.

The coastal area adjacent to the GOM Program Area is very diverse. States along the GOM 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).

14.2.1 *Oil and Gas Activities and Infrastructure*

Oil and gas development and production play important roles in determining land uses in many communities near the GOM. 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 GOM 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 GOM 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 GOM contains 10 of the nation's 20 largest ports by tonnage (as of 2013; AAPA 2013).

The western and central portions of the GOM 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 GOM oil and gas operations are 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 western coast of Florida. Current data indicate there are > 3,531 platforms/rigs in the GOM (as of 2015; BOEM 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 GOM region that support the offshore industry. Platform fabrication facilities are located along the GOM 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 GOM 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 GOM 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.

14.2.2 *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 NASA Use Areas**. Restricted sites used by the military and NASA for operations, testing, and training purposes.

Figures C-24 shows the key ports within the GOM and **Figure C-25** 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.

14.2.2.1 Ports

States along the GOM 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.

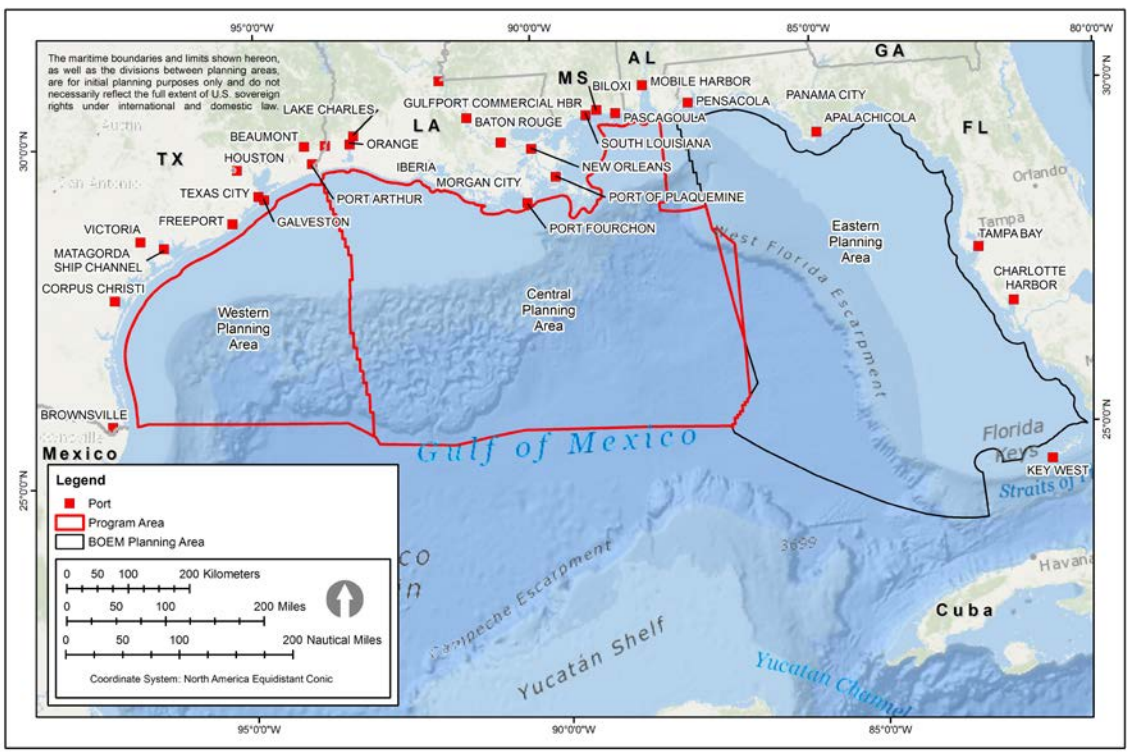


Figure C-24. Key Ports in the Gulf of Mexico

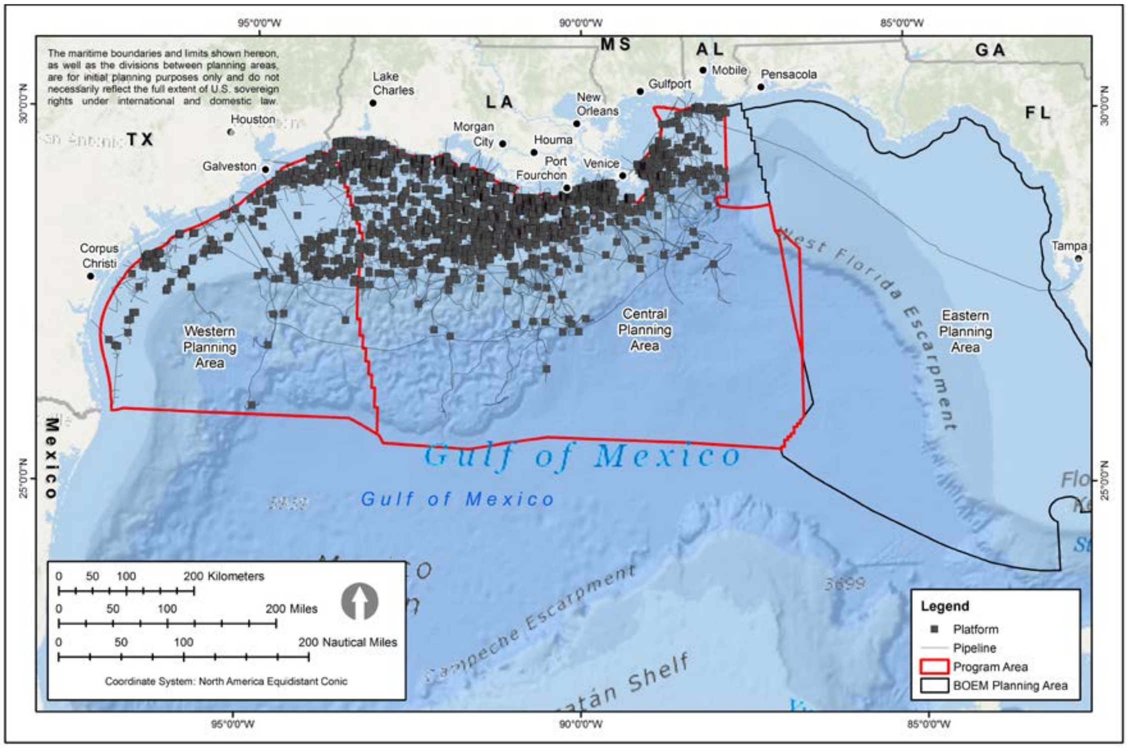


Figure C-25. Key Oil and Gas Onshore and Offshore Infrastructure in the Gulf of Mexico

In addition to servicing the offshore oil and gas industry, a number of GOM 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 GOM (as of 2013; AAPA 2013). These ports, ranked in order of tonnage handled, are as follows:

- South Louisiana, Louisiana (ranked #1, 238.5 million tons)
- Houston, Texas (ranked #2, 229.2 million tons)
- Beaumont, Texas (ranked #4, 94.4 million tons)
- New Orleans, Louisiana (ranked #7, 77.1 million tons)
- Corpus Christi, Texas (ranked #8, 76.1 million tons)
- Baton Rouge, Louisiana (ranked #9, 63.8 million tons)
- Plaquemines, Louisiana (ranked #11, 56.8 million tons)
- Lake Charles, Louisiana (ranked #12, 56.5 million tons)
- Mobile, AL (ranked #13, 53.9 million tons)
- Texas City, Texas (ranked #14, 49.6 million tons)

In 2011, GOM ports accounted for 34.1 percent of U.S. vessel calls, up from 28.7 percent 5 years earlier, due to the large volumes of liquid and dry bulk cargoes they handled. The share of U.S. vessel calls in the GOM increased for six of the seven major vessel types lead by gas and tanker vessels (USDOT 2013a). In addition, GOM 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).

GOM 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.

14.2.2.2 Shipping and Marine Transportation

Eleven commercial deepwater ports are along the GOM, including: 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 GOM by 18.8 percent according to a U.S. Maritime Administration report on Vessel Calls at U.S. Ports (USDOT 2013a).

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-26** provides a map of the GOM's principle ports and waterway networks.

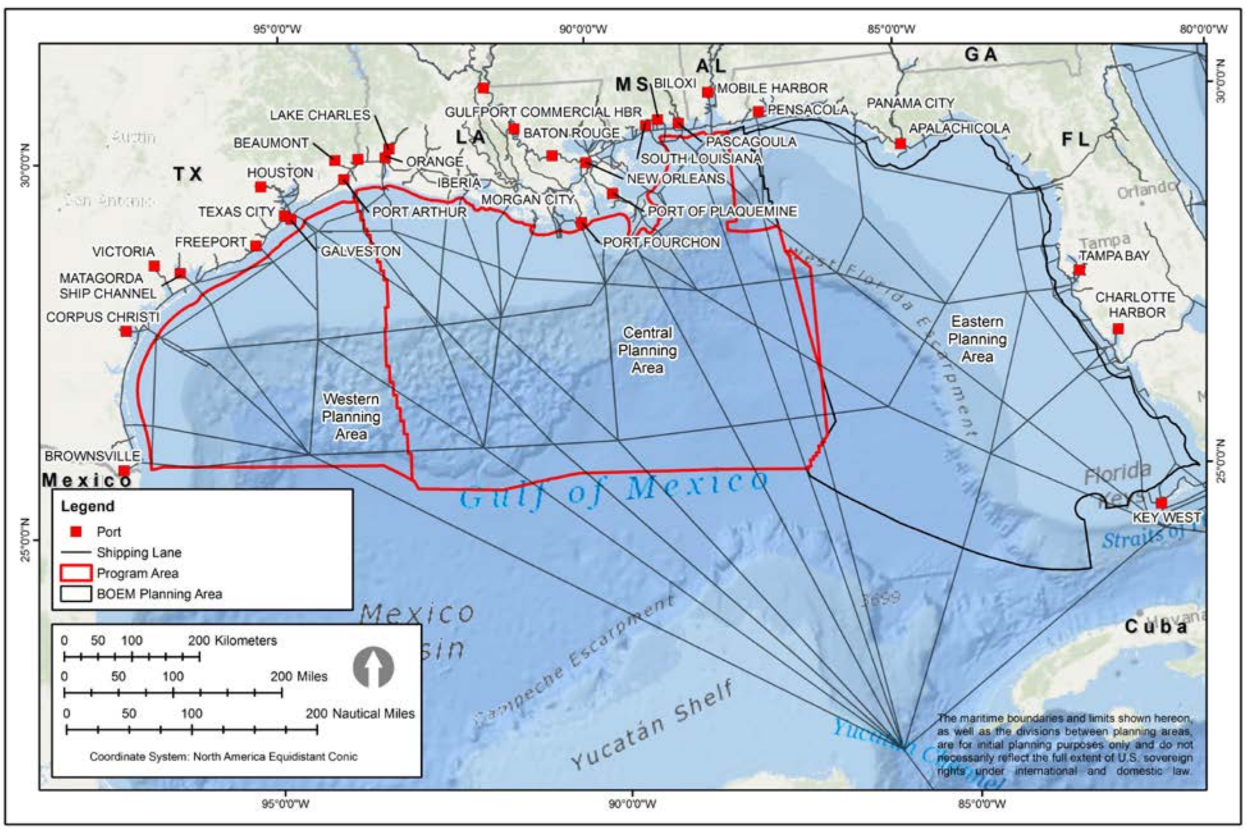


Figure C-26. Gulf of Mexico Principal Ports and Shipping Fairways

14.2.2.3 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 GOM, 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 GOM 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.

14.2.2.4 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 GOM. 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 on the GOM coast (Marine Log 2014). In addition to these shipyards, there are approximately 1,200 other companies in the GOM 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 GOM region are primarily in Texas and Louisiana; however, several are 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 GOM 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 2013b). **Table C-20** below shows the total private sector direct employment in the industry, by state, for the GOM in 2011.

Table C-20. Private Sector Direct Employment in the Gulf of Mexico Shipyard and Shipbuilding Industry in 2011

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**

Source: USDOT 2013b

Total private sector labor income in the GOM shipyard and shipbuilding industry, including wages and salaries and benefits as well as proprietors' income, amounted to $2.8 billion in 2011 (USDOT 2013b). **Table C-21** below shows the total private sector direct labor income for the industry, by state, for the GOM 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-21. Private Sector Direct Labor Income in the Gulf of Mexico Shipyard and Shipbuilding Industry in 2011

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**

Source: USDOT 2013b

14.2.2.5 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 GOM 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 GOM 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.

14.2.2.6 Pipelines

Locations where offshore pipelines cross the shoreline to land are referred to as pipeline landfalls. In the GOM 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-26**. Offshore, there is more than 40,200 km (25,000 mi) of oil and gas pipeline connecting producing areas to pipeline landfalls (NOAA 2012).

Inland, the pipeline network in the GOM's coastal states is extensive. Pipelines transport crude oil and natural gas to processing plants and refineries, natural gas from producing states in the GOM region to users in other states, refined petroleum products such as gasoline and diesel from refineries in the GOM region to markets all over the country, and chemical products.

14.2.2.7 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 GOM region are 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 GOM 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.

14.2.2.8 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 GOM, representing 46 percent of U.S. gas processing capacity (USEIA 2012). More than half of the current natural gas processing plant capacity in the U.S. is near the GOM'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.

14.2.2.9 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 along the coast of the GOM (USEIA 2014), with 36 percent of the operable refineries located in Texas, Louisiana, Mississippi, and Alabama (USEIA 2014). **Table C-22** provides details on the refining capacity in the GOM region. The combined capacity of Texas and Louisiana represents > 47 percent of total operating U.S. refining capacity (USEIA 2014).

Table C-22. Refining Capacity in the Gulf of Mexico Region

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**

Source: USEIA 2014

14.2.2.10 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 (USCB 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.

14.2.2.11 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 (BOEM 2015b).

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
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 GOM region that handle OCS oil and gas activity-related waste include transfer facilities, salt dome disposal facilities, and landfills.

14.2.3 *Land Use*

14.2.3.1 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 GOM (BOEM 2015c).

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 GOM.

14.2.3.2 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-27**.

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

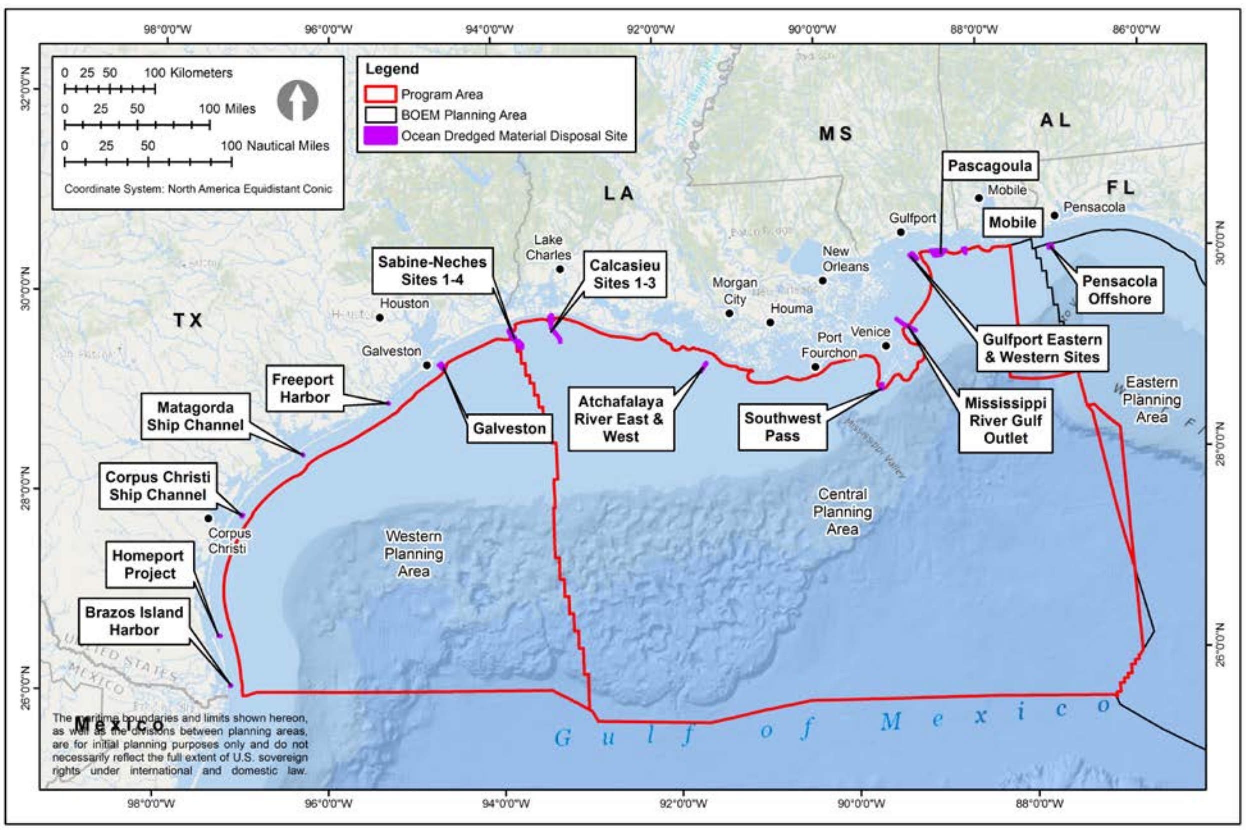


Figure C-27. Offshore Dredged Material Disposal Sites in the Gulf of Mexico

14.2.3.3 Military Use Areas

The GOM region has a large USDOD presence with multiple Navy and Air Force facilities along the coastal zone. The following is a list of USDOD facilities located by state in the GOM Program Area.

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

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-28** shows the location of the military use areas in the GOM region. The region also has a number of military dumping areas (**Figure C-28**). These dumping areas are classified according to whether spoil, ordinance, chemical waste, or vessel waste is deposited in the area.

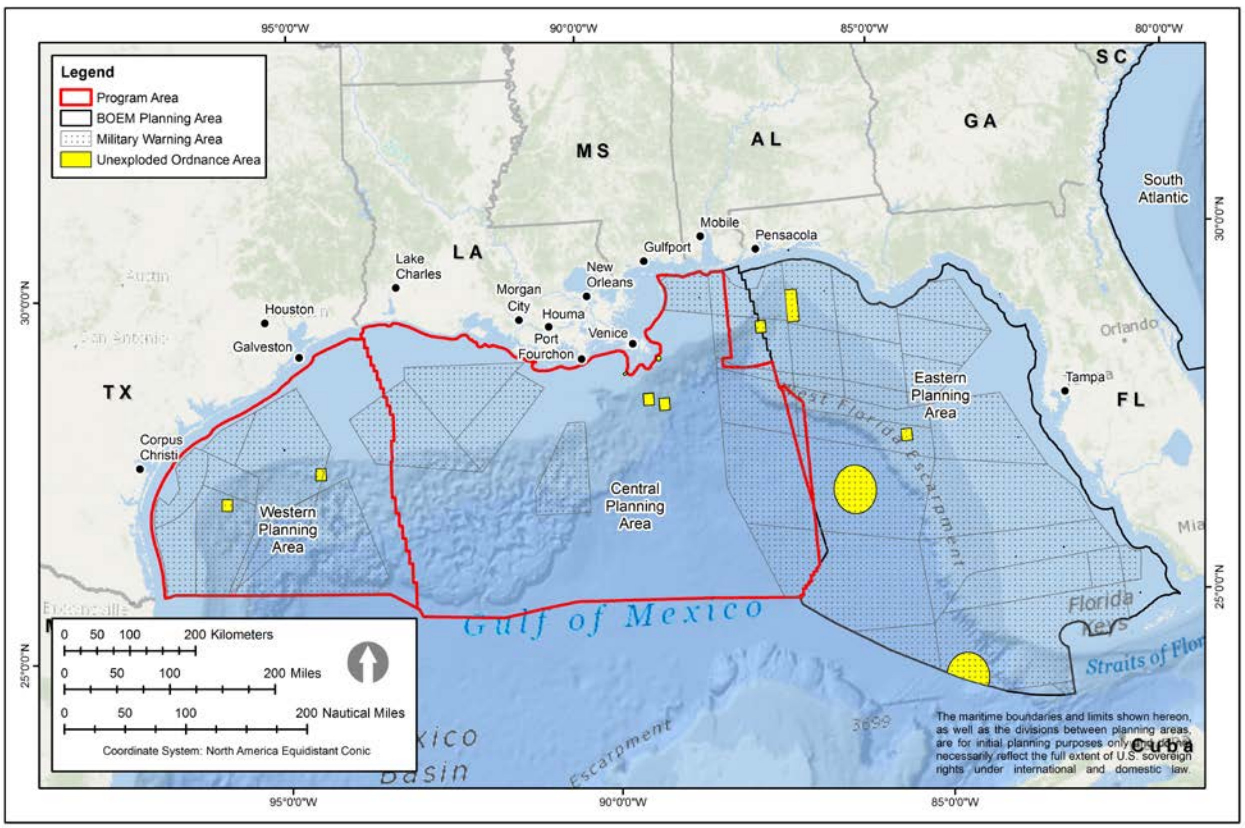


Figure C-28. Military Use Areas in the Gulf of Mexico

The U.S. Air Force has established multiple surface danger zones and restricted areas in the GOM 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 GOM are associated with Elgin Air Force Base (AFB) and Tyndall AFB, both of which are in the Florida Panhandle (outside of the GOM 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 GOM (**Figure C-28**). 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 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 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.

15. COMMERCIAL AND RECREATIONAL FISHERIES

15.1 ALASKA PROGRAM AREA

15.1.1 *Beaufort Sea and Chukchi Sea Planning Areas*

Fisheries in the Beaufort and Chukchi Seas include some commercial and recreational. These two fishery types are discussed in the following section.

15.1.1.1 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). 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 could 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 could 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 could expand northward (e.g., walleye pollock, and yellowfin sole [*Limanda aspera*]) (NMFS 2009b). Consequently, in the coming decades, commercially viable populations of fish and shellfish could develop in the Arctic, but development of a fishery in Federal waters depends on Federal approval.

15.1.1.1.1 Commercial Landings

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 per year and whitefishes and Dolly Varden char accounted for approximately 100 to 300 tons per year 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 per day (MBC Applied Environmental Sciences 2004, ABR, Inc. et al. 2007).

15.1.1.1.2 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.

15.1.2 ***Cook Inlet Planning Area***

15.1.2.1 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 (NMFS 2015h). 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, 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 western side of Cook Inlet.

15.1.2.1.1 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 lbs, lincod was 10,442 lbs, sablefish was 57,350 lbs, Pacific cod was 778,857 lbs, and pollock was 5,751 lbs (Russ et al. 2013). A total of 348,294 lbs of razor clams and 29 tons of herring were commercially harvested in 2014 (Shields and Dupuis 2015).

15.1.2.1.2 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 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 could be used in other areas. Herring sac roe could be harvested using seine, purse seine, or gill net gear (Hollowell 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 could 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 ADF&G, Division of Commercial Fisheries, manages all commercial groundfish fisheries in Cook Inlet, where groundfish are typically harvested in the LCI Management Area.

15.1.2.1.3 Commercial Fishing 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 ADF&G (2015).

15.1.2.1.4 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 inches and no greater than 2.5 inches (Shields and Dupuis 2015). Over the past 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 (5 AAC 27.465); however, nothing has been approved (Hollowell et al. 2015). Smelt can 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 eastern side of Cook Inlet is set aside for sport harvesting of razor clams, and the western 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).

15.1.2.2 Recreational Fisheries

Recreational fish species primarily include five salmon species (sockeye, pink, chum, coho, and Chinook), Pacific halibut, rockfish species, and lingcod (Kerkvliet 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 (Kerkvliet et al. 2013).

15.1.2.2.1 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 (Kerkvliet 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 (Kerkvliet et al. 2013).

15.1.2.2.2 Recreational Fishing Gear

Chinook and other salmon are fished through trolling, coho are fished by trolling or jigging (Kerkvliet et al. 2013). Razor and other clams are hand-collected only.

15.1.2.2.3 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 (Kerkvliet 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 eastern 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 (Kerkvliet et al. 2013). Littleneck and butter clams are collected in the intertidal zone, primarily along beaches of the LCI.

15.1.2.2.4 Time and Area Closures and Gear Restrictions

Kerkvliet 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.

15.2 GULF OF MEXICO PROGRAM AREA

15.2.1 *Commercial Fisheries*

The states within the GOM 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, western Florida commercial fisheries generally are not discussed in this section.

The GOM 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 (NMFS 2015i). 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 (NMFS 2014b).

In 2012, the seafood industry in the four coastal states adjacent to the GOM Program Area supported nearly 78,000 jobs (**Table C-23**). 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 GOM economy. In 2012, the GOM 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-23. Economic Impacts of the Gulf of Mexico Region Seafood Industry (Thousands of Dollars) in 2012

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**

Source: NMFS 2014b

15.2.1.1 Commercial Landings

Table C-24 shows commercial landings in thousands of pounds of key species or species groups within the four GOM states, including blue crab, groupers, menhaden, mullets, oysters, red snapper, shrimp, crawfish, and tunas (NMFS 2014b). 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 GOM states (1.31 billion pounds) in 2012.

Commercial fisheries in the GOM 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-24**) 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 GOM 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-24. Total Landings and Landings of Key Species/Species Groups (Thousands of Pounds)

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**

Source: NMFS 2014b
Key: * = All landings from Louisiana

15.2.1.2 Commercial Fishing Gears

The main commercial fishing gears used within the program area and along the GOM coast are bottom trawls, purse seines, gill nets, pots/traps, and bottom and pelagic longlines. **Table C-25** provides the species sought, seasons, and general areas fished with each gear type.

Bottom trawls are large bag-shaped 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 GOM Program Area during spring and summer months.

Gill nets are constructed of long panels of monofilament netting (mesh size: 3 to 4 inches) 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.

Pots 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 GOM 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 , large coastal sharks), coastal pelagic species (e.g., dolphinfish, wahoo), or pelagic species (e.g., tunas, swordfish, pelagic sharks) (Stevenson et al. 2004).

15.2.1.3 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-25** summarizes this information for key species or species groups targeted in the GOM.

Table C-25. 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

Key: GOM= Gulf of Mexico

15.2.1.4 Time and Area Closures and Gear Restrictions

One method that FMCs uses 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, announces 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-26** summarizes areas where certain commercial fishing activities are prohibited or where gear restrictions apply during all or part of the year. **Figure C-29** shows the locations of most of these closure areas.

Table C-26. Seasonal and/or Area Closures to Commercial Fishing in Federal Waters in the Gulf of Mexico

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 the quota is 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 cannot 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.

Source: Modified from NMFS 2016, 50 CFR § 622.34
Notes: GOM = Gulf of Mexico; EEZ = Economic Exclusion Zone; HAPC = Habitat Area of Particular Concern; MPA = Marine Protected Area; SMZ = Special Management Zone

15.2.1 *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 (USFWS and USCB 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 GOM Program Area are among the most valuable in the U.S. Louisiana ranked highest among the four GOM states adjacent to the program area, and third nationally (behind eastern and western Florida) for total expenditures and durable goods expenditures related to recreational fishing ($1.9 billion) (Lovell et al. 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).

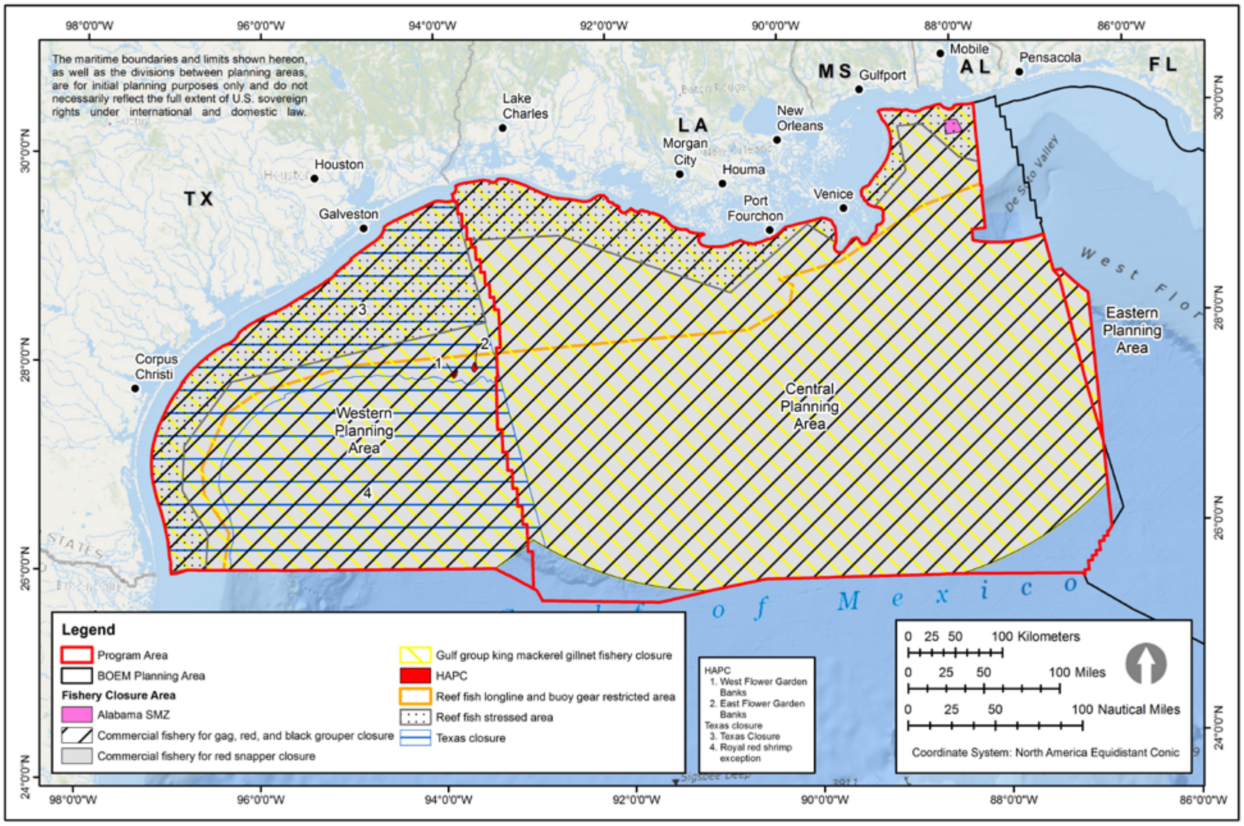


Figure C-29. Locations of Commercial Fishing Closures in Gulf of Mexico Federal Waters

Among the four GOM 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-27**; NMFS 2014b). 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 GOM (64 percent) (Coleman et al. 2004).

Table C-27. Economic Impacts of Recreational Fishing Expenditures (Thousands of Dollars) in 2012

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

Source: NMFS 2014b
Key: N/A = not applicable.
Note: the Marine Recreational Program (MRIP) does not collect effort data for Texas.

15.2.1.1 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 (NMFS 2014b). Recreational fishing effort within the GOM in 2012 consisted of more than 1.9 million recreational anglers taking 8.3 million trips (**Table C-28**). 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, 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]) (NMFS 2014b).

Table C-28. Number of Recreational Fishing Anglers and Angler Trips by Location and Mode in Louisiana, Mississippi, and Alabama between 2003 and 2012

Type	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Number of Anglers (Thousands of Anglers)										
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 (Thousands of Trips)										
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**

Source: NMFS 2014b
Note: MRIP does not collect effort data for Texas

15.2.1.2 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.

15.2.1.3 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 GOM 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 GOM Program Area. The key species and the number of fish caught per year between 2003 and 2012 are presented in **Table C-29**. Of the GOM 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-29**).

15.2.1.1 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, 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 GOM 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-30**). Many of these fishing tournaments are held in conjunction with seafood festivals or other local festivals in the community.

Table C-29. Recreational Harvest and Release of Key Species and Species Groups (Thousands of Fish)

Species	Harvest (H)/ Release (R)	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

Source: NMFS 2014b

Key: H = harvest; R = release; * = Sharks include requiem shark family, blacktip sharks, Atlantic sharpnose sharks, and unidentified sharks.

Notes: No release data were available from Texas. Data collected by the TPWG not from MRIP are reported in this table.

Table C-30. 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

16. TOURISM AND RECREATION

16.1 ALASKA PROGRAM AREAS

16.1.1 *Beaufort Sea and Chukchi Sea Planning Areas*

16.1.1.1 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.

Visitors to the 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 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 would 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 can 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. Despite numerous opportunities for recreation and tourism, there is only one place for lodging (Port of Dutch Harbor 2015).

16.1.1.2 Recreation and Tourism Employment

Recreation and tourism are not major sources of employment in NSB and Northwest Arctic Borough (**Table C-31**). 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 (MIIS 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-32**.

16.1.2 *Cook Inlet Planning Area*

16.1.2.1 Recreational Resources

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.

Table C-31. Number of People Employed in Recreation and Tourism, Arctic Region

Sector	North Slope Borough	Northwest Arctic Borough	Arctic Region Total
Sporting goods stores	*	*	*
Scenic tours	*	*	*
Automotive rental	*	*	*
Museums and historic sites	*	*	*
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	*	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]**

Source: USCB 2013
Notes: * = 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-32. Past, Present, and Reasonable Foreseeable Future Recreation and Tourism

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

Source: BOEM 2012a

16.1.2.2 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-33**). 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-33. Number of People Employed in Recreation and Tourism, Upper Cook Inlet Region, 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]**

Source: USCB 2013
Notes:
[a] Estimate of 20 to 99 employees.
[b] Total range using low and high employee estimates.
[c] Estimate of 0 to 19 employees.

16.2 GULF OF MEXICO PROGRAM AREA

16.2.1 *Western Planning Area*

The western GOM is a popular destination for domestic and foreign tourists. The mild climate and coastal waters provide numerous recreational venues. Beach visitation, recreational fishing, boating and diving, nature watching, and other water-based activities are among primary tourist activities.

There are 169 public beaches on the western GOM’s 367 mi of coastline. GOM 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 GOM via numerous Federal, state, and local parks and wildlife refuges; public and private boat docks and marinas; boat launches; and equipment rental and tour boat companies.

In Texas, Padre Island National Seashore (PINS) is of particular note. 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 (NPS 2015). Outdoor activities at PINS include birding, kayaking, windsurfing, surfing, and wade fishing. Tourism is important to the regional economies of the GOM. In 2013, 142,860 workers were employed in the travel and tourism industry in the coastal counties adjacent to the Western Planning Area.

16.2.2 *Central Planning Area*

The central GOM is a popular destination for domestic and foreign tourists. As in other areas along the GOM, the mild climate and coastal waters provide opportunities for recreation, including beach visitation, recreational fishing, boating and diving, and nature watching.

There are 75 public beaches on 494 mi of coast in the central GOM. In a typical year, beaches along the Central GOM accommodate nearly 2.8 million visitors during nearly 24.5 million annual visitor days (**Table C-34**) (USEPA n.d., NOS 2008). Tourists can access the central GOM 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.

The tourism and recreation industry plays a large role in the economy of the central GOM 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 (USCB 2013).

Table C-34. Numbers of Public Beaches, Visitors, and Visitor Days in Coastal Areas of the Central Gulf of Mexico

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**

Source: USEPA n.d., NOS 2008

17. SOCIOCULTURAL SYSTEMS

Please see **Section 4.3.16** in the Programmatic EIS for a description of the affected environment for sociocultural resources. Since the information is brief relative to the other resources, it does not need further detail in this appendix.

18. 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 (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.

Additional key terms mentioned in **Section 4.3.17** in the Programmatic EIS from the 1997, CEQ (1997) guidance for implementing EO 12898 are as follows:

Minority population: Minority populations should be identified where either: (a) the minority population of the affected area exceeds 50 percent or (b) the minority population percentage of the affected area is meaningfully greater than the minority population percentage in the general population or other appropriate unit of geographic analysis. In identifying minority communities, agencies may consider as a community either a group of individuals living in geographic proximity to one another, or a geographically dispersed/transient set of individuals (such as migrant workers or Native American), where either type of group experiences common conditions of environmental exposure or effect. The selection of the appropriate unit of geographic analysis may be a governing body's jurisdiction, a neighborhood, census tract, or other similar unit that is to be chosen so as to not artificially dilute or inflate the affected minority population. A minority population also exists if there is more than one minority group present and the minority percentage, as calculated by aggregating all minority persons, meets one of the above stated thresholds.

Disproportionately high and adverse human health effects: When determining whether human health effects are disproportionately high and adverse, agencies are to consider the following three factors to the extent practicable:

(a) Whether the health effects, which may be measured in risks and rates, are significant (as employed by NEPA), or above generally accepted norms. Adverse health effects may include bodily impairment, infirmity, illness, or death;

(b) Whether the risk or rate of hazard exposure by a minority population, low income population, or Indian Tribe to an environmental hazard is significant (as employed by NEPA) and appreciably exceeds or is likely to appreciably exceed the risk or rate to the general population or other appropriate comparison group; and

(c) Whether health effects occur in a minority population, low-income population, or Indian Tribe affected by cumulative or multiple adverse exposures from environmental hazards.

Disproportionately high and adverse environmental effects: When determining whether environmental effects are disproportionately high and adverse, agencies are to consider the following three factors to the extent practicable:

(a) Whether there is or will be an impact on the natural or physical environment that significantly (as employed by NEPA) and adversely affects a minority population, low-income population, or Indian Tribe. Such effects may include ecological, cultural, human health, economic, or social impacts on minority communities, low-income communities, or Indian tribes when those impacts are interrelated to impacts on the natural or physical environment;

(b) Whether environmental effects are significant (as employed by NEPA) and are or may be having an adverse impact on minority populations, low income populations, or Indian Tribes that appreciably exceeds or is likely to appreciably exceed those on the general population or other appropriate comparison group; and

(c) Whether the environmental effects occur or would occur in a minority population, low-income population, or Indian Tribe affected by cumulative or multiple adverse exposures from environmental hazards."

Items of Importance:

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 communities of color and low-income populations. If the analysis determines that health and environmental impacts are not significant, there can be no disproportionate impacts on communities of color 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 communities of color.

The geographic distribution of communities of color 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 communities of color and low-income population groups:

Minority: Persons 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 can 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" (Esri 2012).

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 (DeNavas-Walt and Proctor 2015).

CEQ guidance recommends that communities of color 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").

18.1 ALASKA PROGRAM AREAS

18.1.1 *Beaufort Sea and Chukchi Sea Planning Areas*

Table C-35. Percent living below the Poverty Threshold in Coastal Counties of the Beaufort Sea and Chukchi Sea Planning Areas, Alaska

Borough	Percent below the Poverty Threshold
Kenai Peninsula Borough	8.6
North Slope Borough	10.3
Northwest Arctic Borough	22.0

18.1.2 *Cook Inlet Planning Area*

Table C-36. Percent living below the Poverty Threshold in Coastal Counties of the Cook Inlet Planning Area, Alaska

Borough	Census-Designated Place*	Percent below the Poverty Threshold
Anchorage	Anchorage	8.3
Kenai Peninsula Borough	Nikiski	5.9
Kenai Peninsula Borough	Salamatof	12.9
Kenai Peninsula Borough	Kenai	9.3
Kenai Peninsula Borough	Soldotna	3.4
Kenai Peninsula Borough	Kalifornsky	3.9
Kenai Peninsula Borough	Cohoe	16.1
Kenai Peninsula Borough	Kasilof	5.6
Kenai Peninsula Borough	Clam Gulch	13.5
Kenai Peninsula Borough	Ninilchik	16.9
Kenai Peninsula Borough	Happy Valley	13.5
Kenai Peninsula Borough	Anchor Point	11.2
Kenai Peninsula Borough	Homer	12.1
Kenai Peninsula Borough	Tyonek	21.7
Kenai Peninsula Borough	Beluga	40.0

Key: * = 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.

18.2 GULF OF MEXICO PROGRAM AREA

18.2.1 *Western Planning Area*

Table C-37. Percent living below the Poverty Threshold in Coastal Counties of the Western Planning Area, Texas

County	Percent below the Poverty Threshold
Aransas County	19.6
Brazoria County	11.2
Calhoun County	17.6
Cameron County	34.8
Chambers County	9.7
Galveston County	13.3
Harris County	18.5
Jackson County	12.7
Jefferson County	21.0
Kenedy County	32.8
Kleberg County	24.5
Matagorda County	21.1
Nueces County	18.4
Orange County	14.4
Refugio County	16.2
San Patricio County	17.0
Victoria County	16.9
Willacy County	40.0

18.2.2 *Central Planning Area*

Table C-38. Percent living below the Poverty Threshold in Coastal Counties of the Central Planning Area

State	County	Percent 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

State	County	Percent below the Poverty Threshold
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
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

References

5 AAC 27.463. 2006. Eastern, Outer, and Southern Districts Herring Management Plan. July 5, 2006. Available online at: http://www.touchngo.com/lglcntr/akstats/aac/title05/chapter027/section463.htm. Accessed October 7, 2016.

5 AAC 27.465. 2006. Kamishak Bay District Herring Management Plan. July 5, 2006. Available online at: http://www.touchngo.com/lglcntr/akstats/aac/title05/chapter027/section465.htm. Accessed October 7, 2016.

32 FR 4001. 1967. Endangered Species List. U.S. Department of the Interior, U.S. Fish and Wildlife Service. March 11, 1967. Available online at: http://ecos.fws.gov/docs/federal_register/fr18.pdf. Accessed October 11, 2016.

38 FR 14678. 1973. Amendments to Lists of Endangered Fish and Wildlife. June 4, 1973. Available online at: https://ecos.fws.gov/docs/federal_register/fr30.pdf. Accessed October 11, 2016.

42 FR 40685. 1977. Determination of Critical Habitat for Six Endangered Species Including Palila, Renumbering of Critical Habitat Listings; (Florida Everglades kite, *Rostrhamus sociabilis plumbeus*; American peregrine falcon, *Falco peregrinus anatum*; palila *Psittirostra bailleui*; dusky seaside sparrow, *Ammospiza maritima nigrescens*; Cape Sable sparrow, *Ammospiza maritima mirabilis*; Morro Bay kangaroo rat, *Dipodomus heermanni morroensis*). U.S. Department of the Interior, U.S. Fish and Wildlife Service. August 11, 1977. Available online at: http://ecos.fws.gov/docs/federal_register/fr151.pdf. Accessed October 11, 2016.

43 FR 36588. 1978. Endangered and Threatened Wildlife and Plants; Proposed Critical Habitat for the Whooping Crane. U.S. Department of the Interior, U.S. Fish and Wildlife Service. August 17, 1978. Available online at: http://www.fws.gov/ecos/ajax/docs/federal_register/fr237.pdf. Accessed October 11, 2016.

50 FR 50726. 1985. Determination of Endangered and Threatened Status for Piping Plover. December 11, 1985.

52 FR 42064. 1987. Endangered and Threatened Wildlife and Plants; Determination of Endangered and Threatened Status for 2 Populations of Roseate Tern. U.S. Department of the Interior, U.S. Fish and Wildlife Service. November 2, 1987. Available online at: http://ecos.fws.gov/docs/federal_register/fr1346.pdf. Accessed October 11, 2016.

58 FR 27474. 1993. Endangered and Threatened Wildlife and Plants; Final Rule to List Spectacled Eider as Threatened. U.S. Department of the Interior, U.S. Fish and Wildlife Service. May 10, 1993. Available online at: http://alaska.usgs.gov/science/biology/seaducks/pdfs/federal_register_58_88.pdf. Accessed October 11, 2016.

58 FR 45269. 1993. Designated Critical Habitat; Steller Sea Lion. U.S. Department of Commerce, National Marine Fisheries Service. August 27, 1993. Available online at: http://www.fisheries.noaa.gov/pr/pdfs/fr/fr58-45269.pdf. Accessed October 11, 2016.

59 FR 7629. 1994. Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations. Executive Order 12898. February 11, 1994. Available online at: http://www.archives.gov/federal-register/executive-orders/pdf/12898.pdf. Accessed October 11, 2016.

62 FR 31748. 1997. Endangered and Threatened Wildlife and Plants; Threatened Status for the Alaska Breeding Population of the Steller's Eider. U.S. Department of the Interior, U.S. Fish and Wildlife Service. June 11, 1997. Available online at: https://www.gpo.gov/fdsys/pkg/FR-1997-06-11/pdf/97-15244.pdf. Accessed October 11, 2016.

65 FR 46643. 2000. Endangered and Threatened Wildlife and Plants; Final Rule to List the Short-Tailed Albatross as Endangered in the United States. U.S. Department of the Interior, U.S. Fish and Wildlife Service. July 31, 2000. Available online at: https://www.gpo.gov/fdsys/pkg/FR-2000-07-31/pdf/00-19223.pdf. Accessed October 11, 2016.

66 FR 8850. 2001. Endangered and Threatened Wildlife and Plants; Final Determination of Critical Habitat for the Alaska-Breeding Population of Steller's Eider. U.S. Department of the Interior, U.S. Fish and Wildlife Service. February 2, 2001. Available online at: https://www.gpo.gov/fdsys/pkg/FR-2001-02-02/pdf/01-1334.pdf. Accessed October 11, 2016.

66 FR 36038. 2001. Endangered and Threatened Wildlife and Plants; Final Determination of Critical Habitat for Wintering Piping Plovers. July 10, 2001. Available online at: http://www.gpo.gov/fdsys/pkg/FR-2001-07-10/pdf/01-16905.pdf. Accessed October 11, 2016.

68 FR 13370. 2003. Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for the Gulf Sturgeon. U.S. Department of the Interior, U.S. Fish and Wildlife Service. March 19, 2003. Available online at: http://www.gpo.gov/fdsys/pkg/FR-2003-03-19/pdf/03-5208.pdf. Accessed October 11, 2016.

68 FR 15674. 2003. Endangered and Threatened Species; Final Endangered Status for a Distinct Population Segment of Smalltooth Sawfish (*Pristis pectinate*) in the United States. U.S. Department of Commerce, National Oceanic and Atmospheric Administration. April 1, 2003. Available online at: http://www.gpo.gov/fdsys/pkg/FR-2003-04-01/pdf/03-7786.pdf. Accessed October 11, 2016.

70 FR 46366. 2005. Endangered and Threatened Wildlife and Plants; Determination of Threatened Status for the Southwest Alaska Distinct Population Segment of the Northern Sea Otter (*Enhydra lutris kenyoni*). U.S. Department of the Interior, U.S. Fish and Wildlife Service. August 9, 2005. Available online at: https://www.gpo.gov/fdsys/pkg/FR-2005-08-09/pdf/05-15718.pdf. Accessed October 11, 2016.

71 FR 38277. 2006. Endangered and Threatened Species; Revision of Critical Habitat for the Northern Right Whale in the Pacific Ocean. U.S. Department of Commerce, National Marine Fisheries Service. July 6, 2006. Available online at: https://www.gpo.gov/fdsys/pkg/FR-2006-07-06/pdf/06-6014.pdf. Accessed October 11, 2016.

71 FR 53756. 2006. Endangered and Threatened Wildlife and Plants; Review of Native Species That Are Candidates or Proposed for Listing as Endangered or Threatened; Annual Notice of Findings on Resubmitted Petitions; Annual Description of Progress on Listing Actions. September 12, 2006. U.S. Department of the Interior, U.S. Fish and Wildlife Service. Available online at: http://www.gpo.gov/fdsys/pkg/FR-2006-09-12/pdf/06-7375.pdf. Accessed October 11, 2016.

72 FR 62736. 2007. Endangered and Threatened Wildlife and Plants; Critical Habitat Revised Designation for the Cape Sable Seaside Sparrow. U.S. Department of the Interior, U.S. Fish and Wildlife Service. November 6, 2007. Available online at: https://www.gpo.gov/fdsys/pkg/FR-2007-11-06/pdf/07-5460.pdf. Accessed October 11, 2016.

73 FR 19000. 2008. Endangered and Threatened Species; Designation of Critical Habitat for the North Pacific Right Whale. U.S. Department of Commerce, National Marine Fisheries Service. April 8, 2008. Available online at: http://www.nmfs.noaa.gov/pr/pdfs/fr/fr73-19000.pdf. Accessed October 11, 2016.

73 FR 28212. 2008. Endangered and Threatened Wildlife and Plants; Determination of Threatened Status for the Polar Bear (*Ursus maritimus*) Throughout Its Range. U.S. Department of the Interior, U.S. Fish and Wildlife Service. May 15, 2008. Available online at: https://www.gpo.gov/fdsys/pkg/FR-2008-05-15/pdf/E8-11105.pdf. Accessed October 11, 2016.

74 FR 23476. 2009. Endangered and Threatened Wildlife and Plants; Revised Designation of Critical Habitat for the Wintering Population of the Piping Plover (*Charadrius melodus*) in Texas. U.S. Department of the Interior, U.S. Fish and Wildlife Service. May 19, 2009. Available online at: http://www.gpo.gov/fdsys/pkg/FR-2009-05-19/pdf/E9-11245.pdf. Accessed October 11, 2016.

74 FR 51988. 2009. Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for the Southwest Alaska Distinct Population Segment of the Northern Sea Otter. U.S. Department of the Interior, U.S. Fish and Wildlife Service. October 8, 2009. Available online at: https://www.gpo.gov/fdsys/pkg/FR-2009-10-08/pdf/E9-24087.pdf. Accessed October 11, 2016.

75 FR 76086. 2010. Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for the Polar Bear (*Ursus maritimus*) in the United States. U.S. Department of the Interior, U.S. Fish and Wildlife Service. December 7, 2010. Available online at: https://www.gpo.gov/fdsys/pkg/FR-2010-12-07/pdf/2010-29925.pdf. Accessed October 11, 2016.

76 FR 20180. 2011. Endangered and Threatened Species: Designation of Critical Habitat for Cook Inlet Beluga Whale. U.S. Department of Commerce, National Marine Fisheries Service. April 11, 2011. Available online at: https://www.gpo.gov/fdsys/pkg/FR-2011-04-11/pdf/2011-8361.pdf. Accessed October 11, 2016.

76 FR 59064. 2011. Fisheries of the Caribbean, Gulf of Mexico, and South Atlantic; Stone Crab Fishery of the Gulf of Mexico; Removal of Regulations. U.S. Department of Commerce, National Oceanic and Atmospheric Administration. September 23, 2011. Available online at: https://www.gpo.gov/fdsys/pkg/FR-2011-09-23/pdf/2011-24274.pdf. Accessed October 11, 2016.

77 FR 75570. 2012. Fisheries of the Exclusive Economic Zone Off Alaska; Pacific Salmon. U.S. Department of Commerce, National Oceanic and Atmospheric Administration. December 21, 2012. Available online at: https://alaskafisheries.noaa.gov/sites/default/files/finalrules/77fr75570.pdf. Accessed October 11, 2016.

77 FR 75947. 2012. Endangered and Threatened Wildlife and Plants; Reclassification of the Continental U.S. Breeding Population of the Wood Stork From Endangered to Threatened. U.S. Department of the Interior, U.S. Fish and Wildlife Service. December 26, 2012. Available online at: https://www.gpo.gov/fdsys/pkg/FR-2012-12-26/pdf/2012-30731.pdf. Accessed October 11, 2016.

78 FR 11766. 2013. Endangered and Threatened Wildlife and Plants; Special Rule for the Polar Bear under Section 4(d) of the Endangered Species Act. U.S. Department of the Interior, U.S. Fish and Wildlife Service. February 20, 2013. Available online at: https://www.gpo.gov/fdsys/pkg/FR-2013-02-20/pdf/2013-03136.pdf. Accessed October 11, 2016.

78 FR 61764. 2013. Endangered and Threatened Wildlife and Plants; 12-Month Finding on a Petition to List Kittlitz's Murrelet as an Endangered or Threatened Species. U.S. Department of the Interior, U.S. Fish and Wildlife Service. October 3, 2013. Available online at: https://www.gpo.gov/fdsys/pkg/FR-2013-10-03/pdf/2013-24172.pdf. Accessed October 11, 2016.

78 FR 66140. 2013. Endangered and Threatened Species; Delisting of the Eastern Distinct Population Segment of Steller Sea Lion under the Endangered Species Act; Amendment to Special Protection Measures for Endangered Marine Mammals. U.S. Department of Commerce, National Marine Fisheries Service. November 4, 2013. Available online at: https://www.gpo.gov/fdsys/pkg/FR-2013-11-04/pdf/2013-25261.pdf. Accessed October 11, 2016.

78 FR 68032. Endangered and Threatened Wildlife; Notice of 12-Month Finding on a Petition to List the Sperm Whale (*Physeter macrocephalus*) as an Endangered or Threatened Distinct Population Segment (DPS) in the Gulf of Mexico. U.S. Department of Commerce, National Marine Fisheries Service. November 12, 2013. Available online at: https://www.gpo.gov/fdsys/pkg/FR-2013-11-13/pdf/2013-27180.pdf. Accessed October 11, 2016.

79 FR 37078. 2014. Endangered and Threatened Wildlife and Plants, Reclassification of the U.S. Breeding Population of the Wood Stork From Endangered to Threatened; Final Rule. U.S. Department of the Interior, U.S. Fish and Wildlife Service. June 30, 2014. Available online at: http://www.gpo.gov/fdsys/pkg/FR-2014-06-30/pdf/2014-14761.pdf. Accessed October 11, 2016.

79 FR 39756. 2014. Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for the Northwest Atlantic Ocean Distinct Population Segment of the Loggerhead Sea Turtle. U.S. Department of the Interior, U.S. Fish and Wildlife Service. July 10, 2014. Available online at: https://www.gpo.gov/fdsys/pkg/FR-2014-07-10/pdf/2014-15725.pdf. Accessed October 11, 2016.

79 FR 39856. 2014. Endangered and Threatened Species: Critical Habitat for the Northwest Atlantic Ocean Loggerhead Sea Turtle Distinct Population Segment (DPS) and Determination Regarding Critical Habitat for the North Pacific Ocean Loggerhead DPS. U.S. Department of Commerce, National Marine Fisheries Service. July 10, 2014. Available online at: https://www.gpo.gov/fdsys/pkg/FR-2014-07-10/pdf/2014-15748.pdf. Accessed October 11, 2016.

79 FR 59195. 2014. Endangered and Threatened Wildlife and Plants; 12-Month Finding on a Petition To List the Yellow-Billed Loon as an Endangered or a Threatened Species. U.S. Department of the Interior, U.S. Fish and Wildlife Service. October 1, 2014. Available online at: https://www.fws.gov/alaska/informationquality/pdf/20141001_YBLO_12MonthFinding_2014-23297.pdf. Accessed October 11, 2016.

79 FR 72450. 2014. Endangered and Threatened Wildlife and Plants; Review of Native Species That are Candidates for Listing as Endangered or Threatened; Annual Notice of Findings on Resubmitted Petitions; Annual Description of Progress on Listing Actions. U.S. Department of the Interior, U.S. Fish and Wildlife Service. December 5, 2014. Available online at: http://www.gpo.gov/fdsys/pkg/FR-2014-12-05/pdf/2014-28536.pdf. Accessed October 11, 2016.

79 FR 73706. 2014. Threatened Species Status for the Rufa Red Knot. U.S. Department of the Interior, U.S. Fish and Wildlife Service. December 11, 2014. Available online at: http://www.gpo.gov/fdsys/pkg/FR-2014-12-11/pdf/2014-28338.pdf. Accessed October 11, 2016.

81 FR 36664. 2016. Marine Mammals; Incidental Take During Specified Activities. U.S. Department of the Interior, U.S. Fish and Wildlife Service. June 7, 2016. Available online at: https://www.gpo.gov/fdsys/pkg/FR-2016-06-07/pdf/2016-13124.pdf. Accessed October 11, 2016.

ABR, Inc. Environmental Research & Services; Sigma Plus, Statistical Consulting Services; Stephen R. Braund & Associates; and Kuukpik Subsistence Oversight Panel, Inc. 2007. Variation in the Abundance of Arctic Cisco in the Colville River: Analysis of Existing Data and Local Knowledge, Volumes I and II. OCS Study MMS 2007-042. MMS, Alaska OCS Region, Anchorage, AK.

Agler, B.A., S.J. Kendall, P.E. Seiser, and D.B. Irons. 1995. Monitoring Seabird Populations in Areas of Oil and Gas Development on the Alaskan Continental Shelf: Estimates of Marine Bird and Sea Otter Abundance in Lower Cook Inlet, Alaska during Summer 1993 and Winter 1994. OCS Study MMS 94-0063. MMS, Alaska OCS Region, Anchorage, AK.

Alaska Department of Commerce. 2011. Planning and Land Management Powers, Alaska Division of Community and Regional Affairs. Available online at: https://www.commerce.alaska.gov/web/Portals/4/pub/Planning_Powers_Poster.pdf. Accessed October 11, 2016.

Alaska Department of Commerce. 2012. Alaska Planning Commission Handbook. January 2012.

ADF&G (Alaska Department of Fish and Game). 2015. Steller's Eider (*Polysticta stelleri*) Species Profile. Available online at: http://www.adfg.alaska.gov/index.cfm?adfg=stellerseider.main. Accessed August 30, 2016.

Alaska Department of Labor and Workforce Development. 2014. Research and Analysis. Available online at: http://live.laborstats.alaska.gov/cen/. Accessed August 15, 2015.

ADNR (Alaska Department of Natural Resources). 1999. North Slope Oil and Gas Lease 87: North Slope Areawide 1999, Final Finding of the Director, Division of Oil and Gas, Department of Natural Resources.

ADNR. 2009. Beaufort Sea Areawide Oil and Gas Lease Sale Final Finding of the Director. Division of Oil and Gas, Anchorage, Alaska, Nov. 9.

ADNR, Division of Oil and Gas. 2012. Cook Inlet Oil and Gas Program and Community Map. Available online at: http://dog.dnr.alaska.gov/Publications/Documents/CookInlet/Maps/O&G_Program_&_Communities_20120112.pdf. Accessed October 11, 2016.

ADNR, Division of Oil and Gas. 2016a. North Slope Oil and Gas Activity Map. Available online at: http://dog.dnr.alaska.gov/gis/data/activitymaps/northslope/northslopeoilandgasactivitymap-201605.pdf. Accessed October 5, 2016.

ADNR, Division of Oil and Gas. 2016b. Cook Inlet Oil and Gas Activity Map. Available online at: http://dog.dnr.alaska.gov/gis/data/activitymaps/cookinlet/cookinletoilandgasactivitymap-201605.pdf. Accessed October 5, 2016.

Alaska Department of Revenue. 2014. Revenue Sources Book, Spring 2014. Available online at: http://www.tax.alaska.gov/programs/documentviewer/viewer.aspx?1048r. Accessed October 11, 2016.

Alaska History and Cultural Studies. 2015. Alaska's Heritage: Chapter 4-12: Air Transportation. Available online at: http://www.akhistorycourse.org/americas-territory/alaskas-heritage/chapter-4-12-air-transportation. Accessed July 15, 2016.

Alaska Volcano Observatory. 2014a. Augustine Reported Activity. Available online at: https://avo.alaska.edu/volcanoes/volcact.php?volcname=Augustine. Accessed July 10, 2015.

Alaska Volcano Observatory. 2014b. Redoubt Reported Activity. Available online at: https://avo.alaska.edu/volcanoes/volcact.php?volcname=Redoubt. Accessed July 10, 2015.

Allan, S.E., B.W. Smith, and K.A. Anderson. 2012. Impact of the Deepwater Horizon Oil Spill on Bioavailable Polycyclic Aromatic Hydrocarbons in Gulf of Mexico Coastal Waters. Environ. Sci. Technol. 46:2033-2039.

Allen, B.M. and R.P. Angliss. 2011. Alaska Marine Mammal Stock Assessments, 2010. U.S. Department of Commerce, NOAA Tech. Memo. NMFSAFSC-223, 292 p. Available online at: http://www.nmfs.noaa.gov/pr/pdfs/sars/ak2010.pdf. Accessed October 11, 2016.

Allen, B.M. and R.P. Angliss. 2013. Alaska Marine Mammal Stock Assessments, 2012. U.S. Department of Commerce, NOAA Tech. Memo. NMFSAFSC-245, 282 p. Available online at: http://www.nmfs.noaa.gov/pr/sars/pdf/ak2012.pdf. Accessed October 11, 2016.

Allen, B.M. and R.P. Angliss. 2014. Alaska Marine Mammal Stock Assessments, 2013. U.S. Department of Commerce, NOAA Tech. Memo. NMFSAFSC-277, 294 p. Available online at: http://www.nmfs.noaa.gov/pr/sars/pdf/ak2013_final.pdf. Accessed October 11, 2016.

AAPA (American Association of Port Authorities). 2012. North America Port Container Traffic Ranking 2011. AAPA Advisory, April 30, 2012. Available online at: http://aapa.files.cms-plus.com/PDFs/NORTH%20AMERICA%20PORT%20CONTAINER%20TRAFFIC%20RANKING%202011_1361895265064_1.pdf. Accessed October 11, 2016.

AAPA. 2013. U.S. Port Ranking by Cargo Tonnage 2013. Available online at: http://aapa.files.cms-plus.com/Copy%20of%202013%20U%20S%20%20PORT%20RANKINGS%20BY%20CARGO%20TONNAGE_1427222227746_1.xlsx. Accessed October 11, 2016.

Amstrup, S.C. 2003. Polar bear. In: Feldhammer GA, Thompson BC, Chapman JA (eds) Wild Mammals of North America. Biology, Management, and Conservation, 2nd edn. Johns Hopkins University Press, Baltimore, pp 587–610.

Amstrup, S.C. and C. Gardner. 1994. Polar Bear Maternity Denning in the Beaufort Sea. J Wildl. Manage. 58:1–10.

Amstrup, S.C., I. Stirling, T.S. Smith, C. Perham, and G.W. Thiemann. 2006. Recent Observations of Intraspecific Predation and Cannibalism among Polar Bears in the Southern Beaufort Sea. Polar Biol 29:997-1002. Available online at: http://www.polarbearsinternational.org/sites/default/files/amstrupetal2006cannibalism.pdf. Accessed October 11, 2016.

Anuskiewicz, R.J. and J.S. Dunbar. 1993. Evidence of Prehistoric Man at Ray Hole Springs: A Drowned Sinkhole Located 32 Km Offshore on the Continental Shelf in 12 M Seawater, pp. 1-11 in Proceedings of the American Academy of Underwater Sciences Thirteenth Annual Scientific Diving Symposium, John N. Heine and Nicole L. Crane (eds.), American Academy of Underwater Sciences, Pacific Grove, CA.

Audubon Alaska. 2013. Important Bird Areas. Anchorage: Audubon Alaska. Available online at: http://ak.audubon.org/important-bird-areas-4. Accessed May 7, 2015.

Audubon Society. 2010. Important Bird Areas along the Gulf Coast: Priority Sites. Available online at: http://web4.audubon.org/bird/iba/gulfIBAs_list.html. Accessed May 14, 2015.

Audubon Society. 2013. Criteria overview. Available online at: http://web4.audubon.org/bird/iba/criteria.html. Accessed February 4, 2015.

Augerot, X. 2005. Atlas of Pacific Salmon, University of California Press, Berkeley, CA.

Bagur, J.D. 1978. Barrier Islands of the Atlantic and Gulf Coasts of the United States: An Annotated Bibliography. U.S. Fish and Wildlife Service, Biological Services Program FWS/OBS-77/56. 215 pp.

Bailey, R.G. 1978. Ecoregions of the United States. U.S. Forest Service, Ogden UT.

Baird, R.W. 2002. False Killer Whale *Pseudorca crassidens*. In W.F. Perrin, B. Würsig and J.G.M. Thewissen (Eds.), *Encyclopedia of Marine Mammals*. (pp. 411-412). San Diego, CA: Academic Press.

Baker, C.S., S.R. Palumbi, R.H. Lambertsen, M.T. Weinrich, J. Calambokidis, and S.J. O'Brien. 1990. Influence of Seasonal Migration on Geographic Distribution of Mitochondrial DNA Haplotypes in Humpback Whales. Nature 344(15):238-240.

Baldwin, A.H. and I.A. Mendelssohn. 1998. Effects of Salinity and Water Level on Coastal Marshes: An Experimental Test of Disturbance as a Catalyst for Vegetation Change. Aquatic Botany 61(4):255-268.

Ball, D., R. Clayburn, R. Cordero, B. Edwards, V. Grussing, J. Ledford, R. McConnell, Tr. Monette, R. Steelquist, E. Thorsgard, and J. Townsend. 2015. A Guidance Document for Characterizing Tribal Cultural Landscapes. OCS Study BOEM 2015-047. BOEM, Pacific OCS Region, Camarillo, CA.

Balmer, B.C., R.S. Wells, S.M. Nowacek, D.P. Nowacek, L.H. Shwacke, W.A. Mclellan, F.S. Scharf, T.K. Rowles, L.J. Hansen, T.R. Spradlin, and D.A. Pabst. 2008. Seasonal Abundance and Distribution Patterns of Common Bottlenose Dolphins (*Tursiops truncates*) Near St. Joseph Bay, Florida, USA. J. Cetacean Res. Manage. 10(2):157-167.

Barbier, E.B., S.D. Hacker, C. Kennedy, E.W. Koch, A.C. Stier, and B.R. Silliman. 2011. The Value of Estuarine and Coastal Ecosystem Services. Ecological Monographs 81(2):169-193.

Barros, N.B., D.A. Duffield, P.H. Ostrom, D.K. Odell, and V.R. Cornish. 1998. Nearshore vs. Offshore Ecotype Differentiation of *Kogia breviceps* and *K. simus* based on Hemoglobin, Morphometric and Dietary Analyses. World Marine Mammal Science Conference Abstracts. Monaco. 20-24 January.

Battaglia, L.L., M.S. Woodrey, M.S. Peterson, K.S. Dillon, and J.M. Visser. 2012. Wetlands of the Northern Gulf Coast. Berkeley, CA: University of California Press.

Baumgartner, M.F. 1997. The Distribution of Risso's Dolphin (*Grampus griseus*) with Respect to Physiography in the Northern Gulf of Mexico. Mar. Mamm. Sci. 13:614-638.

Bell, F.W. 1993. Current and Projected Tourism Demand for Saltwater Recreational Fisheries in Florida (No. 111). Florida Sea Grant College Program, University of Florida.

Bennett, A. 1996. Physical and Biological Resource Inventory of the Lake Clark National Park-Cook Inlet Coastline, 1994–1996. Unpublished report, National Park Service, Kenai, Alaska.

Bergerud, A.T. 1974. The Role of the Environment in the Aggregation, Movement and Disturbance Behaviour of Caribou. In V. Geist and F. Walther (Eds.), *The Behaviour of ungulates and its relation to management* (pp. 552-584). Morges, Switzerland: International Union for Conservation of Nature and Natural Resources.

Bergerud, A.T. 1987. An Assessment of Petroleum on the Status of the Porcupine Caribou Herd. In: Arctic National Wildlife Refuge, Alaska Coastal Plain Resource Assessment. Report and Recommendation to the Congress of the U.S. and Final Legislative Environmental Impact Statement Vol. 2 Appendix, Public Comments and Responses. Washington, DC: Department of the Interior, U.S. Fish and Wildlife Service.

Bergerud, A.T. and J.P. Elliot. 1986. Dynamics of Caribou and Wolves in Northern British Columbia. Canadian Journal Zoology 64:1515-1529.

Berman, B.D. 1973. Encyclopedia of American Shipwrecks. Boston, MA: The Mariner's Press.

Berzin, A.A. and A.A. Rovnin. 1966. Distribution and Migration of Whales in the Northeastern Part of the Pacific Ocean, Bering, and Chukchi Seas. Izv. Tikhookean. Naucho-issled. Institute; Rybn-Khoz. Okeanogr. (TINRO) 58:179-207. (In Russian.)

Biggs, D.C., R.R. Leben and J.G. Ortega-Ortiz. 2000. Ship and Satellite Studies of Mesoscale Circulation and Sperm Whale Habitats in the Northeast Gulf of Mexico during GulfCet II. Gulf Mex. Sci. 18:15-22.

Biggs, P.B., A.E. Jochens, N.K. Howard, S.F. Di Marco, K.D. Mullin, R.F. Leben, F.E. Muller-Karger, and C. Hu. 2005. Eddy forced variations in On- and Off-Margin Summertime Circulation along the 1000-m Isobath of the Northern Gulf of Mexico, 2000-2003, and Links with Sperm Whale Distributions around the Middle Slope. Circulation in the Gulf of Mexico: Observations and Models. Geophysical Monograph Series 161. American Geophysical Union. pp. 71-85.

BirdLife International. 2015. Species Factsheet: *Polysticta stelleri*. Available online at: http://www.birdlife.org/datazone/species/factsheet/22680415. Accessed May 7, 2015.

Bjorndal, K.A. 1997. Foraging Ecology and Nutrition of Sea Turtles. In P.L. Lutz and J.A. Musick (Eds.), *The Biology of Sea Turtles* (pp. 199-231). Boca Raton, FL: CRC Press.

Bjorndal, K.A. 1999. Conservation of Hawksbill Sea Turtles: Perceptions and Realities. Chelonian Conservation and Biology 3(2):174-176.

Bluhm, B. and R. Gradinger. 2008. Regional Variability in Food Availability for Arctic Marine Mammals. Ecological Applications 18(2): S77-S96.

Bockstoce, J.R. 2006. Nineteenth Century Commercial Shipping Losses in the Northern Bering Sea, Chukchi Sea, and Beaufort Sea. The Northern Mariner/Le marin du nord 16(2):53-68.

Boehm, P.D., L.L. Cook, and K.J. Murray. 2011. Aromatic Hydrocarbon Concentrations in Seawater: Deepwater Horizon Oil Spill. Presented at the International Oil Spill Conference, Portland, OR, May 23-26, 2011.

Braham, H.W. and D.W. Rice. 1984. The Right Whale, *Balaena glacialis*. Marine Fisheries Review 46:38-44.

Brakstad, O.G., T. Nordtug, and M. Throne-Holst. 2015. Biodegradation of Dispersed Macondo Oil in Seawater at Low Temperature and Different Oil Droplet Sizes. Marine Pollution Bulletin. 93:144-152.

Breder C.M. 1952. On the Utility of the Saw of the Sawfish. Copeia 2:90–91.

Bromaghin, J.F., T.L. McDonald, I. Stirling, A.E. Derocher, E.S. Richardson, E.V. Regher, D.C. Douglas, G.M. Durner, T. Atwood, and S.C. Amstrupl. 2015. Polar Bear Population Dynamics in the Southern Neaufort Sea during a Period of Sea Ice Decline. Ecological Applications. 25(3):634-651.

Brook, R.K. and E.S. Richardson. 2002. Observations of Polar Bear Predatory Behavior toward Caribou. Arctic 55(2):193-196.

Brown, L.F. Jr., J.H. McGowen, T.J. Evans, C.G. Groat, W.L. Fisher, J.W. Macon, D.F. Scranton, B. Hartmann, and P.T. Flawn. 1977. Environmental Geological Atlas of the Texas Coastal Zone: Kingsville Area, University of Texas, Bureau of Economic Geology, Austin, TX.

Brown, S., C. Hickey, B. Harrington, and R. Gill. 2001. United States Shorebird Conservation Plan. 2nd edition. Manomet Center for Conservation Sciences, Manomet, MA.

Brueggeman, J.J., R.A. Grotefendt, and A.W. Erickson. 1984. Endangered Whale Abundance and Distribution in the Navarin Basin of the Bering Sea During the Ice-Free Period. In B.R. Melteff and D.H. Rosenberg, (Eds.), *Proceedings of the Workshop on Biological Interactions among Marine Mammals and Commercial Fisheries in Southeastern Bering Sea, October 18-21, 1983, Anchorage, AK.* (pp. 201-236.) Alaska Sea Grant Report 84-1, University of Alaska.

Brueggeman, J.J., G.A. Green, R.W. Tressler, and D.G. Chapman. 1988. Shipboard Surveys of Endangered Cetaceans in the Northwestern Gulf of Alaska. Final Report. Outer Continental Shelf Environmental Assessment Program. Research Unit 673.

BLM (Bureau of Land Management). 2008. Northeast National Petroleum Reserve-Alaska Supplemental Integrated Activity Plan Record of Decision.

BOEM (Bureau of Ocean Energy Management). 2011. BOEM Alaskan Shipwreck Table. BOEM, Alaska OCS Region, Anchorage, AK.

BOEM. 2012a. Final Programmatic Environmental Impact Statement, Outer Continental Shelf Oil and Gas Leasing Program: 2012-2017. OCS EIS/EA BOEM 2012-030. BOEM, Headquarters, Herndon, VA.

BOEM. 2012b. Gulf of Mexico OCS Oil and Gas Lease Sales: 2012-2017; Western Planning Area Lease Sales 229, 233, 238, 246, and 248; Central Planning Area Lease Sales 227, 231, 235, 241, and 247 – Final Environmental Impact Statement. 3 vols. OCS EIS/EA BOEM 2012-019. BOEM, Gulf of Mexico OCS Region, New Orleans, LA.

BOEM. 2013. Gulf of Mexico OCS Oil and Gas Lease Sales: 2014 and 2016. Eastern Planning Area Lease Sales 225 and 226. Final Environmental Impact Statement. 2 vols. OCS EIS/EA BOEM 2013-200. BOEM, Gulf of Mexico OCS Region, New Orleans, LA.

BOEM. 2014. Chukchi Sea Planning Area, Oil and Gas Lease Sale 193 in the Chukchi Sea, Alaska. Draft Second Supplemental Environmental Impact Statement, Volume 1. OCS EIS/EA BOEM 2014-653. BOEM, Alaska OCS Region, Anchorage, AK.

BOEM. 2015a. Gulf of Mexico OCS Oil and Gas Lease Sales: 2016 and 2017. Central Planning Area Lease Sales 241 and 247. Eastern Planning Area Lease Sale 226. Draft Environmental Impact Statement. OCS EIS/EA BOEM 2015-001. BOEM, Gulf of Mexico OCS Region, New Orleans, LA.

BOEM. 2015b. Questions, Answers, and Related Resources. Available online at: http://www.boem.gov/Environmental-Stewardship/Environmental-Assessment/CWA/Offshore-Discharges-From-Oil-and-Gas-Development-Operations---FAQ.aspx. Accessed October 11, 2016.

BOEM. 2015c. Offshore Wind Energy. Available online at: http://www.boem.gov/renewable-energy-program/renewable-energy-guide/offshore-wind-energy.aspx. Accessed October 11, 2016.

BOEM. 2015d. Platform (Structures) Locations in the Gulf. Available online at: https://www.data.boem.gov/homepg/data_center/platform/platform.asp#pdf. Accessed August 1, 2016.

BOEMRE (Bureau of Ocean Energy Management, Regulation and Enforcement). 2010. Chukchi Sea Planning Area Oil and Gas Lease Sale 193 in the Chukchi Sea, Alaska. Draft Supplemental Environmental Impact Statement. OCS EIS/EA 2010-034. BOEMRE, Alaska OCS Region, Anchorage, AK.

Byrnes M.R., J.D. Rosati, S.F. Griffee, and J.L. Berlinghoff. 2013. Historical Sediment Transport Pathways and Quantities for Determining an Operational Sediment Budget: Mississippi Sound Barrier Islands. Journal of Coastal Research 63:166-183.

Byron, D. and K.L. Heck. 2006. Hurricane Effects on Seagrasses along Alabama's Gulf Coast. Estuaries and Coasts 29(6):939-942.

Caldwell, D.K. and M.C. Caldwell. 1989. Pygmy Sperm Whale *Kogia breviceps* (de Blainville 1838): Dwarf Sperm Whale *Kogia simus* (Owen 1866). In S.H. Ridgway and R. Harrison (Eds.), *Handbook of Marine Mammals, Vol. 4: River Dolphins and the Larger Toothed Whales*. (pp. 235-260). San Diego, CA: Academic Press.

Calvert, W. and I. Stirling. 1990. Interactions between Polar Bears and Overwintering Walrus in the Central Canadian high Arctic. International Conference on Bear Research and Management 8:351-356.

Camilli, R., C.M. Reddy, D.R. Yoerger, B.A.S. Van Mooy, M.V. Jakuba, J.C. Kinsey, C.P. McIntyre, S.P. Sylva, and J.V. Maloney. 2010. Tracking Hydrocarbon Plume Transport and Biodegradation at Deepwater Horizon. Science 330:201-204.

Carlson, Jr., P.R., L.A. Yarbro, K.A. Kaufman, and R.A. Mattson. 2010. Vulnerability and Resilience of Seagrasses to Hurricane and Runoff Impacts along Florida's West Coast. Hydrobiologia 649(1):39-53.

Carretta, J.V., S.M. Wilkin, M.M. Muto, and K. Wilkinson. 2013. Sources of Human-Related Injury and Mortality for U.S. Pacific West Coast Marine Mammal Stock Assessments, 2007-2011. U.S. Department of Commerce, NOAA Technical Memorandum, NMFS-SWFSC-514.

Carretta, J.V., K.A. Forney, E. Oleson, K. Martien, M.M. Muto, M.S. Lowry, J. Barlow, J. Baker, B. Hanson, D. Lynch, L. Carswell, R.L. Brownell Jr., J. Robbins, D.K. Mattila, K. Ralls, and Marie C. Hill. 2011. U.S. Pacific Marine Mammal Stock Assessments: 2010. U.S. Department of Commerce, NOAA Technical Memorandum, NMFS-SWFSC-476.

Carretta, J.V., E. Oleson, D.W. Weller, A.R. Lang, K.A. Forney, J. Baker, B. Hanson, K. Martien, M.M. Muto, A.J. Orr, H.H. Huber, M.S. Lowry, J. Barlow, D. Lynch, L. Carswell, R.L. Brownell Jr., and D. K. Mattila. 2014. U.S. Pacific Marine Mammal Stock Assessments: 2013. U.S. Department of Commerce, NOAA Technical Memorandum, NMFS-SWFSC-532.

Carroll, G. 1992. Teshekpuk Lake Caribou Herd, Game Management Unit 26A. In S.M. Abbott (Ed.), Caribou Surveys Inventory Management Report, 1 July 1989-30 June 1991, Federal Aid in Wildlife Restoration Project W-23-1 and W-23-4 Study 3.0. Juneau, AK: State of Alaska, Department of Fish and Game.

Carroll, G., L.S. Parrett, J.C. George, and D.A. Yokel. 2005. Calving Distribution of the Teshekpuk Lake Caribou Herd, 1994-2003. Rangifer Special Issue 16:27-35.

CBC News, Canada. 2015. Franklin Expedition Search: Ice Dive Team Ready to Discover More Secrets of HMS Erebus. Available online at: http://www.cbc.ca/news/canada/franklin-expedition-search-ice-dive-team-ready-to-discover-more-secrets-of-hms-erebus-1.3020860. Accessed July 14, 2015.

Chanton, J., T. Zhao, B.E. Rosenheim, S. Joye, S. Bosman, C. Brunner, K.M. Yeager, A.R. Diercks, and D. Hollander). 2015. Using Natural Abundance Radiocarbon to Trace the Flux of Petrocarbon to the Seafloor Following the Deepwater Horizon Oil Spill. Environmental Science & Technology 49:84-854.

Chiquet, R.A., B. Ma, A.S. Ackleh, N. Pal, N. Sidorovskaia. 2013. Demographic Analysis of Sperm Whales Using Matrix Population Models. Ecol Model 248: 71-79.

Church, R.A., D.J. Warren, J.B. Weirich, and D.A. Ball. 2004, February 17-19. *Return to the U-166: Working Together to Meet the Challenge of Deepwater Archaeology.* Paper presented at Marine Technology Society: Conference on Underwater Intervention, New Orleans, LA. Red Hook, NY: Curran Associates, Inc.

Citta, J. and L. Lowry. 2008. Beluga Whale. Alaska Wildlife Notebook Series. Alaska Department of Fish and Game. Juneau, AK.

Clapp, R.B., R.C. Banks, D. Morgan-Jacobs, and W.A. Hoffman. 1982a. Marine Birds of the Southeastern United States and Gulf of Mexico. Part I. Gaviiformes through Pelecaniformes. U.S. Fish and Wildlife Service, Office of Biological Services, Washington, D.C. FWS/OBS-82/01.

Clapp, R.B., D. Morgan-Jacobs, and R.C. Banks. 1982b. Marine Birds of the Southeastern United States and Gulf of Mexico. Part II. Anseriformes. U.S. Fish and Wildlife Service, Office of Biological Services, Washington, DC. FWS/OBS-82/20.

Clapp, R.B., D. Morgan-Jacobs, and R.C. Banks. 1983. Marine Birds of the Southeastern United States and Gulf of Mexico. Part III. Charadriiformes. U.S. Fish and Wildlife Service, Office of Biological Services, Washington, DC. FWS/OBS-83/30.

Clarke, J.T., C.L. Christman, A.A. Brower, and M.C. Ferguson. 2013. Distribution and Relative Abundance of Marine Mammals in the Northeastern Chukchi and Western Beaufort Seas, 2012. Annual Report. OCS Study BOEM 2013-00117. BOEM, Alaska OCS Region, Anchorage, AK.

Clarke, J.T., A.A. Brower, C.L. Christman, and M.C. Ferguson. 2014. Distribution and Relative Abundance of Marine Mammals in the Northeastern Chukchi and Western Beaufort Seas, 2013. Annual Report. OCS Study BOEM 2014-018. BOEM, Alaska OCS Region, Anchorage, AK.

Coastal Environments, Inc. 1977. Cultural Resources Evaluation of the Northern Gulf of Mexico Continental Shelf. Volumes I and II. Report submitted to the U.S. Department of the Interior, National Park Service, Office of Archaeology and Historic Preservation, Interagency Archaeological Services, Baton Rouge, LA.

CPRA (Coastal Protection and Restoration Authority). 2014. Barrier Island Status Report: Fiscal Year 2015 Annual Plan.

CPRA. 2015. Oil Spill Restoration - Council-Selected Restoration Component Projects. Available online at: http://coastal.la.gov/oil-spill-content/oil-spill-overview/restore-act/. Accessed May 16, 2015.

Coleman, F.C., W.F. Figueira, J.S. Ueland, and L.B. Crowder. 2004. The Impact of United States Recreational Fisheries on Marine Fish Populations. Science, New Series 305(5692):1958-1960.

Collard, S. 1990. Leatherback Turtles Feeding Near a Watermass Boundary in the Eastern Gulf of Mexico. Marine Turtle Newsletter 50:12-14.

Conant, T.A., P.H. Dutton, T. Eguchi, S.P. Epperly, C.C. Fahy, M.H. Godfrey, S.L. MacPherson, E.E. Possardt, B.A. Schroeder, J.A. Seminoff, M.L. Snover, C.M. Upite, and B.E. Witherington. Loggerhead Sea Turtle (*Caretta caretta*) 2009 Status Review under the U.S. Endangered Species Act. 2009. Report of the Loggerhead Biological Review Team to the National Marine Fisheries Service, August 2009.

Conn, P.B., J.M. Ver Hoef, B.T. McClintock, E.E. Moreland, J.M. London, M.F. Cameron, S.P. Dahle, and P.L. Boveng. 2014. Estimating multispecies abundance using automated detection systems: ice-associated seals in the Bering Sea. Methods Ecol Evol 5:1280–1293.

Consiglieri, L., H. Braham, M. Duhlheim, C. Fiscus, P. McGuire, C. Peterson, and D. Pippenger. 1982. Seasonal Distribution and Relative Abundance of Marine Mammals in the Gulf of Alaska. U.S. Department of Commerce, NOAA, OCSEAP Final Report. 61(1989):189-343.

Cornell Lab of Ornithology. 2015. All about Birds, Red Knot (*Calidris canutus*). Available online at: http://www.allaboutbirds.org/guide/red_knot. Accessed May 11, 2015.

CEQ (Council on Environmental Quality). 1997. Guidance under the National Environmental Policy Act. December 10, 1997.

Cowardin, L.M., V. Carter, F.C. Golet, and E.T. LaRoe. 1979. Classification of Wetlands and Deepwater Habitats of the United States. U.S. Fish and Wildlife Service, Office of Biological Services, Washington, D.C. FWS/OBS-79/31.

Craig, P. and L. Haldorson. 1986. Pacific salmon in the North American Arctic. Arctic 39:2-7.

CSA (Continental Shelf Associates, Inc.) and Martel Laboratories, Inc. 1985. Florida Big Bend Seagrass Habitat Study Narrative Report. OCS Study MMS 85-0088. Continental Shelf Associates, Inc., Jupiter, FL and Martel Laboratories, Inc., St. Petersburg, FL.

CSA. 1987. Assessment of Hurricane Damage in the Florida Big Bend Seagrass Beds. OCS Study MMS 87-0001. Jupiter, FL: Continental Shelf Associates, Inc.

Culik, B. 2010. Odontocetes. The Toothed Whales: *Orcinus orca*. UNEP/CMS Secretariat, Bonn, Germany. Available online at: http://www.cms.int/reports/small_cetaceans/index.htm. Accessed May 2015.

Dahlheim, M., A. York, R. Towell, J. Waite, and J. Breiwick. 2000. Harbor Porpoise (*Phocoena phocoena*) Abundance in Alaska: Bristol Bay to Southeast Alaska, 1991– 1993. Mar. Mamm. Sci. 16:28-45.

Darigo, N., O.K. Mason, and P.M. Bowers. 2007. Review of Geological/Geophysical Data and Core Analysis to Determine Archaeological Potential of Buried Landforms, Beaufort Sea Shelf, Alaska: Final Report. OCS Study MMS 2007-004. MMS, Alaska OCS Region, Anchorage, AK.

Dau, J. 2005. Units 21D, 22A, 22B, 22C, 22D, 22E, 23, 24, and 26A Caribou Management Report. In C. Brown (Ed.), *Caribou Management Report of Survey and Inventory Activities 1 July 2002-30 June 2004, Project 3* (pp. 177-218). Juneau, AK: State of Alaska, Department of Fish and Game.

Davis, J.L., P. Valkenburg, and R.D. Boertje. 1982. Home Range Use, Social Structure, and Habitat Selection of the Western Arctic Caribou Herd. Fairbanks, AK: Alaska Department of Fish and Game.

Davis, R.W. and G.S. Fargion (Eds.). 1996. Distribution and Abundance of Cetaceans in the North-Central and Western Gulf of Mexico: Final Report. Volume II: Technical Report. OCS Study MMS 96-0027. MMS, Gulf of Mexico OCS Region, New Orleans, LA.

Davis, R.W., W.E. Evans and B. Würsig (Eds). 2000. Cetaceans, Sea Turtles and Seabirds in the Northern Gulf of Mexico: Distribution, Abundance and Habitat Associations. Volume II: Technical Report. USGS/BRD/CR-1999-0006 and OCS Study MMS 2000-003. USGS, Biological Resources Division and MMS, Gulf of Mexico OCS Region, New Orleans, LA.

Davis, R.W., G.S. Fargion, N. May, T.D. Leming, M. Baumgartner, W.E. Evans, L.J. Hansen, and K. Mullin. 1998. Physical Habitat of Cetaceans along the Continental Slope in the Northcentral and Western Gulf of Mexico. Mar. Mamm. Sci. 14:490-507.

Davis, R.W., J.G. Ortega-Ortiz, C.A. Ribic, W.E. Evans, D.C. Biggs, P.H. Ressler, R.B. Cady, R.R. Leben, K.D. Mullin, and B. Würsig. 2002. Cetacean Habitat in the Northern Oceanic Gulf of Mexico. Deep-Sea Research I 49:121-142.

Dawes, C.J., R.C. Phillips, and G .Morrison. 2004. Seagrass Communities of the Gulf Coast of Florida: Status and Ecology. Florida Fish and Wildlife Conservation Commission Fish and Wildlife Research Institute and the Tampa Bay Estuary Program, St. Petersburg, FL. iv + 74 pp.

DeLeo, D.M., D.V. Ruiz-Ramos, I.B. Baums, and E.E. Cordes. 2015. In Press. Response of Deep-Water Corals to Oil and Chemical Dispersant Exposure. Deep-Sea Research II.

DeNavas-Walt, C. and B.D. Proctor. 2015. Income and Poverty in the United States: 2014. U.S. Department of Commerce, Economics and Statistics Administration, U.S. Census Bureau.

Derocher, A.E. and Ø .Wiig. 1999. Infanticide and Cannibalism of Juvenile Polar Bears (*Ursus maritimus*) in Svalbard. Arctic 52:307-310.

Derocher, A.E., Ø. Wiig, and G. Bangjord. 2000. Predation of Svalbard Reindeer by Polar Bears. Polar Biol 23:675–678.

Diercks, A.R., V.L. Asper, R.C. Highsmith, D.J. Joung, Z. Zhau, L. Guo, S.E. Lohrenz, A.M. Shiller, S.B. Joye, A.P. Teske, N. Guiasso, and T.L. Wade. 2010. Characterization of Subsurface Polycyclic Aromatic Hydrocarbons at the Deepwater Horizon Site. Geophys. Res. Lett. 37(20):L20602.

Dismukes, D. 2011. Coastal Marine Institute OCS-Related Infrastructure Fact Book Volume I: Post-Hurricane Impact Assessment. OCS Study BOEM 2011-043. BOEM, Gulf of Mexico OCS Region, New Orleans, LA.

Dixon, E.J., S. Stoker, and G. Sharma. 1986. Alaskan Outer Continental Shelf Cultural Compendium. Technical Report Number 119. OCS Study MMS 86-0018. MMS, Alaska OCS Region, Anchorage, AK.

Dufault, S., H. Whitehead, and M. Dillon. 1999. An Examination of the Current Knowledge on the Stock Structure of Sperm Whales (*Physeter macrocephalus*) Worldwide. J. Cetacean Res. Manage. 1(1):1-10.

Dunbar, J. S., S.D. Webb, M. Faught, R.J. Anuskiewicz, and M.I. Stright. 1989. Archaeological Sites in the Drowned Tertiary Karst Region of the Eastern Gulf of Mexico. In J.B. Arnold, III (Ed.). *Underwater Archaeological Proceedings.* Paper presented at The Society for Historical Archaeology Conference, Baltimore, MD (pp. 25-31). The Society for Historical Archaeology.

Dunton, K.H., A. Burd, D. Funk, and R. Maffione. 2004. Linking Water Turbidity and Total 18 Suspended Solids Loading to Kelp Productivity Within the Stefansson Sound Boulder Patch, 19 ANIMIDA Task 6 (Boulder Patch) Final Report. OCS Study MMS 2005-0011. MMS, Alaska OCS Region, Anchorage, AK.

Durner, G.M., S.C. Amstrup, and A.S. Fischbach. 2003. Habitat Characteristics of Polar Bear Terrestrial Maternal Den Sites in Northern Alaska. Arctic 56:55–62.

Durner, G.M., S.C. Amstrup, R. Neilson, and T. McDonald. 2004. The Use of Sea Ice Habitat by Female Polar Bears in the Beaufort Sea. OCS Study MMS 2004-014. Alaska OCS Region, Anchorage, AK.

Dyck, M.G. and K.J. Daley. 2002. Cannibalism of a Yearling Polar Bear (*Ursus maritimus*) at Churchill, Canada. Arctic 55: 190-192.

Eastland, W.G., R.T. Bowyer, and S.G. Fancy. 1989. Effects of Snow Cover on Selection of Calving Sites by Caribou. Journal of Mammalogy 70:824-828.

Edwards, B.R., C.M. Reddy, R. Camilli, C.A. Carmichael, K. Longnecker, and B.A.S. Van Mooy. 2011. Rapid Microbial Respiration of Oil from the Deepwater Horizon Spill in Offshore Surface Waters of the Gulf of Mexico. Environ. Res. Lett. 6(3):035301.

Elias, S.A., S.K. Short, and R.L. Phillips. 1992. Paleoecology of Late Glacial Peats from the Bering Land Bridge, Chukchi Sea Shelf Region, Northwestern Alaska. Quaternary Research 38(3):371-378.

Engelhaupt, D.T. 2004. Phylogeography, Kinship and Molecular Ecology of Sperm Whales (*Physeter macrocephalus*). Durham theses, University of Durham. Available at Durham E-Theses Online: http://etheses.dur.ac.uk/3059/. Accessed October 12, 2016.

Engelhaupt, D., A.R. Hoelzel, C. Nicholson, A. Frantzis, S. Mesnick, S. Gero, H. Whitehead, L. Rendell, P. Miller, R. De Stefanis, A. Cañadas, S. Airoldi and A.A. Mignucci-Giannoni. 2009. Female Philopatry in Coastal Basins and Male Dispersion Across the North Atlantic in a Highly Mobile Marine Species, the Sperm Whale (*Physeter macrocephalus*). Mol. Ecol. 18:4193-4205.

Enticknap, B. and W. Sheard. 2005. Conservation and Management of North Pacific Rockfishes. Alaska Marine Conservation Council. Anchorage, AK.

Ernst, C.H., J.E. Lovich, and R.W. Barbour. 1994. *Turtles of the United States and Canada*. Washington, D.C.: Smithsonian Institution Press.

Esri. 2012. Minority Population Growth – The New Boom. An Analysis of America's Changing Demographics. Available online at: http://www.esri.com/library/brochures/pdfs/minority-population-growth.pdf2012. Accessed on October 11, 2016.

Estes, J.A., D.F. Doak, A.M. Springer and T.M. Willimas. 2009. Causes and Consequences of Marine Mammal Population Declines in Southwest Alaska: A Food-Web Perspective. Philosophical Transactions: Biological Sciences. 364(1524):1647-1658.

Fall, J.A. 2014. Subsistence in Alaska: A Year 2012 Update. Division of Subsistence, Alaska Department of Fish and Game. Anchorage, AK.

Fancy, S.G., L.F. Pank, K.R. Whitten, and W.L. Regelin. 1989. Seasonal Movements of Caribou in Arctic Alaska as Determine by Satellite. Canadian Journal of Zoology 67:644-650.

Faught, M.K. and A.E. Gusick. 2011. Submerged Prehistory in the Americas. In Benjamin, J., C. Bonsall, C. Pickard, and A. Fischer (Eds.), *Submerged Prehistory* (pp. 145-157). Oxford, England: Oxbow Books.

Fay, F.H. 1982. Ecology and Biology of the Pacific Walrus, *Odobenus rosmarus divergens Illiger*. North American Fauna 74:1-279.

Federal Interagency Solutions Group. 2010. Oil Budget Calculator: Deepwater Horizon. Technical Documentation: A Report to the National Incident Command. Oil Budget Calculator Science and Engineering Team. 217 pp.

Ferrero, R.C., and W.A. Walker. 1996. Age, Growth and Reproductive Patterns of the Pacific White-Sided Dolphin (*Lagenorhynchus obliquidens*) Taken in High Seas Driftnets in the Central North Pacific Ocean. Can. J. Mammal. 74(9):1673-1687.

Fertl, D., A.J. Schiro, G.T. Regan, C.A. Beck, N.M. Adimey, L. Price-May, A. Amos, G.A.J. Worthy and R. Crossland. 2005. Manatee Occurrence in the Northern Gulf of Mexico, West of Florida. Gulf and Caribbean Research 17:69-74.

Fischbach, A.S., S.C. Amstrup, and D.C. Douglas. 2007. Landward and Eastward Shift of Alaskan Polar Bear Denning Associated with Recent Sea Ice Changes. Polar Biol. 30:1395-1405.

Fischer, J.B. and W.W. Larned. 2004. Summer Distribution of Marine Birds in the Western Beaufort Sea. Arctic 57(2):143–159.

FDEP (Florida Department of Environmental Protection). 2015. Salt Marshes. Available online at: http://www.dep.state.fl.us/coastal/habitats/saltmarshes.htm. Accessed February 10, 2015.

Foley, A.M., K.E. Singel, P.H. Dutton, T.M. Summers, A.E. Redlow, and J. Lessman. 2007. Characteristics of a Green Turtle Assemblage in Northwestern Florida Determined During a Hypothermic Stunning Event. Gulf of Mexico Science 25(2):131-143.

Fonseca, M.S., W.J. Kenworthy, E. Griffith, M.O. Hall, M. Finkbeiner, and S.S. Bell. 2008. Factors Influencing Landscape Pattern of the Seagrass *Halophila decipiens* in an Oceanic Setting. Estuarine, Coastal and Shelf Science 76(1):163-174.

Forbes, D.L. (Ed.). 2011. State of the Arctic Coast 2010 – Scientific Review and Outlook. International Arctic Science Committee, Land-Ocean Interactions in the Coastal Zone, Arctic Monitoring and Assessment Programme, International Permafrost Association. Geesthacht, Germany: Helmholtz-Zentrum.

Ford, M. 2014. Hurricane Katrina, the Role of U.S. National Parks on the Northern Gulf of Mexico and Post Storm Wetland Restoration. In R. Murti and C. Buyck (Eds.), *IUCN Safe Havens: Protected Areas for Disaster Risk Reduction and Climate Change Adaptation.* (pp. 141-148). Gland, Switzerland: IUCN.

Ford, B., A. Borgens, W. Bryant, D. Marshall, P. Hitchcock, C. Arias, and D. Hamilton. 2008. Archaeological Excavation of the Mardi Gras Shipwreck (16GM01), Gulf of Mexico Continental Slope. OCS Report MMS 2008-037. MMS, Gulf of Mexico OCS Region, New Orleans, LA.

Foster, N.R., D.C. Lees, S. Saupe. 2010. Evaluating a Potential Relect Arctic Invertebrate and Algal Community on the West Site of Cook Inlet. OCS Study MMS 2010-005. BOEMRE, Alaska OCS Region, Anchorage, AK.

Fourqurean, J.W. and L.M. Rutten. 2004. The Impact of Hurricane Georges on Soft-Bottom, Back Reef Communities: Site-and Species-Specific Effects in South Florida Seagrass Beds. Bull. Mar. Sci. 75(2):239-257.

Franze, C.D. 2002. Barrier Island Seagrass and Geomorphic Interactions: A Case Study of Hurricane Damage and Efficacy of Restoration Efforts, at the Chandeleur Islands. (Masters Thesis). University of New Orleans.

Freeman, M.M.R. 1973. Polar Bear Predation on Beluga in the Canadian Arctic. Arctic 26:163-164.

Frey, R.W. and J.D. Howard. 1969. A Profile of Biogenic Sedimentary Structures in a Holocene Barrier Island-Salt Marsh Complex, Georgia. Gulf Coast Association of Geological Societies Transactions 19:427-444.

Fritts, T.H., W. Hoffman, and M.A. McGehee. 1983a. The Distribution and Abundance of Marine Turtles in the Gulf Of Mexico and Nearby Atlantic Waters. Journal of Herpetology 17:327-344.

Fritts, T.H., A.B. Irvine, R.D. Jennings, L.A. Collum, W. Hoffman., and M.A. McGehee. 1983b. Turtles, Birds, and Mammals in the Northern Gulf of Mexico and Nearby Atlantic Waters. U.S. Fish and Wildlife Service, Division of Biological Services, Washington, D.C. FWS/OBS-82/65.

Frost, K. and S. Karpovich. 2008. Gray Whale. Alaska Department of Fish and Game. Available online at: https://www.adfg.alaska.gov/static/education/wns/gray_whale.pdf. Accessed October 11, 2016.

Fulling, G.L., K.D. Mullin and C.W. Hubard. 2003. Abundance and Distribution of Cetaceans in Outer Continental Shelf Waters of the U.S. Gulf of Mexico. Fish. Bull. 101:923-932.

Funk, D.W., L.E. Noel, and A.H. Freedman. 2004. Environmental Gradients, Plant Distribution, and Species Richness in Arctic Salt Marsh near Prudhoe Bay, Alaska. Wetlands Ecology and Management 12:215–233.

Garlich-Miller, J., J.G. MacCracken, J. Snyder, R. Meehan, M. Myers, J.M. Wilder, E. Lance, and A. Matz. 2011. Status Review of the Pacific Walrus (*Odobenus rosmarus divergens*). U.S. Fish and Wildlife Service, Marine Mammals Management.

Garrison, E. G., C. P. Giammona, F. J. Kelly, A. R. Tripp, and G. A. Wolff. 1989. Historic Shipwrecks and Magnetic Anomalies of the Northern Gulf of Mexico: Reevaluation of Archaeological Resource Management Zone 1. Volume II: Technical Narrative. OCS Study MMS 89-0024. MMS, Gulf of Mexico Region, New Orleans, LA.

Garshelis, D.L. and J.A. Garshelis. 1984. Movements and Management of Sea Otters in Alaska. Journal of Wildlife Management 48(3):665-678.

Garshelis, D.L., J.A. Garshelis, and A.T. Kimker. 1986. Sea Otter Time Budgets and Prey Relationships in Alaska. Journal of Wildlife Management 50(4):637-647.

Gill, R.E., Jr. and T.L. Tibbitts. 1999. Seasonal Shorebird Use of Intertidal Habitats in Cook Inlet, Alaska, Final Report. OCS Study MMS 99–0012. MMS, Alaska OCS Region, Anchorage, AK.

Gill, R.E., P.S. Tomkovich, and B.J. McCaffery. 2002. Rock Sandpiper (*Calidris ptilocnemis*). In A. Poole and F. Gill (Eds.), The Birds of North America, No. 686. Philadelphia, Pennsylvania: The Birds of North America, Inc. Available online at: http://www.allaboutbirds.org/guide/Rock_Sandpiper/id. Accessed May 7, 2015.

Godfrey, P.J. 1976. Comparative Ecology of East Coast Barrier Islands: Hydrology, Soil, Vegetation. In: J. Clark, (Ed.), *Technical Proceedings of the 1976 Barrier Island Workshop*. Paper presented at the Barrier Island Workshop, Annapolis, MD (pp. 5-34). The Conservation Foundation.

Goodwin, R.H. and W.A. Niering. 1974. Inland Wetlands: Their Ecological Role and Environmental Status. Bulletin of the Ecological Society of America 55:2–6.

Gorbics, C.S. and J.L. Bodkin. 2001. Stock Structure of Sea Otters (*Enhydra lutris kenyoni*) in Alaska. Marine Mammal Science 17(3):632-647.

Gordon, J., L. Rendell, R. Antunes, N. Jaquet, C. Richter and B. Würsig. 2008. Analysis of Codas from the Gulf of Mexico and Implications for Management. In: A. Jochens, D. Biggs, K. Benoit-Bird, D. Engelhaupt, J. Gordon, C. Hu, N. Jaquet, M. Johnson, R. Leben, B. Mate, P. Miller, J. Ortega-Ortiz, A. Thode, P. Tyack and B Würsig. Sperm Whale Seismic Study in the Gulf of Mexico: Synthesis report. (pp. 201-213). OCS Study MMS 2008-006. MMS, Gulf of Mexico OCS Region, New Orleans, LA.

Gosho, M.E., D.W. Rice, and J.M. Breiwick. 1984. The Sperm Whale, *Physeter macrocephalus*. Mar. Fish. Rev. 46(4):54–64.

Gosselink, J.G., E.P. Odum, and R.M. Pope. 1974. The Value of the Tidal Marsh. Center for Wetland Resources, Louisiana State University, Baton Rouge, LA.

Gradinger, R. and B. Bluhm. 2005. Arctic Ocean Exploration 2002. Polar Biology 28(3):169-170.

Griffith, B., D.C. Douglas, N.E. Walsh, D.D. Young, R.R. McCabe, D.E. Russell, R.G. White, R.D. Cameron, and K.R. Whitten. 2002. The Porcupine Caribou Herd. In D.C. Douglas, P.E. Reynolds, and E.B. Rhodes, (Eds.), *Arctic Refuge Coastal Plain Terrestrial Wildlife Research Summaries, Biological Science Report* USGS/BRD/BSR-2002-0001. (pp. 8-37). Anchorage, AK: U.S. Geological Survey, Biological Resources Division.

GMFMC (Gulf of Mexico Fishery Management Council). 1983. Fishery Management Plan, Final Environmental Impact Statement, Regulatory Impact Review, and Final Regulations for Coastal Migratory Pelagic Resources (Mackerels) in the Gulf of Mexico and South Atlantic Region. Gulf of Mexico Fishery Management Council, Tampa, FL.

GMFMC. 2004. Final Environmental Impact Statement for the Generic Essential Fish Habitat Amendment to the Following Fishery Management Plans of the Gulf of Mexico (GOM). Chapter 8: Tables. National Oceanic and Atmospheric Administration Award No. NA17FC1052. March 2004.

GMFMC. 2005. Generic Amendment Number 3 for Addressing Essential Fish Habitat Requirements, Habitat Areas Of Particular Concern, and Adverse Effects of Fishing in the Following Fishery Management Plans of the Gulf of Mexico: Shrimp Fishery of the Gulf of Mexico, United States Waters Red Drum Fishery of the Gulf of Mexico, Reef Fish Fishery of the Gulf of Mexico Coastal Migratory Pelagic Resources (Mackerels) in the Gulf of Mexico and South Atlantic, Stone Crab

Fishery of the Gulf of Mexico, Spiny Lobster in the Gulf of Mexico and South Atlantic, Coral and Coral Reefs of the Gulf of Mexico. Gulf of Mexico Fishery Management Council, Tampa, FL.

Gulf Restoration Network. 2004. A Guide to Protecting Wetlands in the Gulf of Mexico. Update to Spring 2001.

Hall, J.V., W.E. Frayer, and B.O. Wilen. 1994. Status of Alaska Wetlands. U.S. Fish and Wildlife Service. Alaska Region. Anchorage, AK.

Handley, L., K.A. Spear, C. Thatcher, and S. Wilson (Eds.). 2012. Chapter A. Emergent Wetlands Status and Trends in the Northern Gulf of Mexico, 1950-2010. U.S. Geological Survey Scientific Investigations Report. USGS and USEPA. Available online at: https://gom.usgs.gov/web/documents/EmergentWetlandsIntro.pdf. Accessed on October 11, 2016.

Handley, L., K. Spear, R. Baumstark, R. Moyer, and C. Thatcher. 2015. Statewide Summary for Florida.

Hansen, L.J., K.D. Mullin and C.L. Roden. 1995. Estimates of Cetacean Abundance in the Northern Gulf of Mexico from Vessel Surveys. NOAA MIA-94/95-25, Southeast Fisheries Science Center.

Hansen, L.J., K.D. Mullin, T.A. Jefferson and G.P. Scott. 1996. Visual Surveys aboard Ships and Aircraft. In R.W. Davis and G.S. Fargion (Eds.), *Distribution and Abundance of Marine Mammals in the Northcentral and Western Gulf of Mexico: Final Report Volume II: Technical Report.* (pp. 55-132). OCS Study MMS 96- 0027. MMS, Gulf of Mexico OCS Region, New Orleans, LA.

Harper, P., and L. A. McCarthy, (Eds.) 2015. Caribou Management Report of Survey-Inventory Activities 1 July 2012-30 June 2014. Species Management Report ADF&G/DWC/SMR-2015-4. Juneau, AK: Alaska Department of Fish and Game. Available online at: http://www.adfg.alaska.gov/index.cfm?adfg=wildliferesearch.smr20154. Accessed July 6, 2016.

Harrington, B.A. 2001. Red Knot (*Calidris canutus*), The Birds of North America Online. In A. Poole (Ed.), Ithaca: Cornell Lab of Ornithology. Available online at: http://bna.birds.cornell.edu/bna/species/563. Accessed February 3, 2015.

Harrington, B.A. and R.I.G Morrison. 1979. Semipalmated Sandpiper Migration in North America. In F. A. Pitelka (Ed.), *Shorebirds in Marine Environments Studies in Avian Biology No. 2* (pp.83-100). Berkeley, CA: The Cooper Ornithological Society.

Harrison, P. 1983. *Seabirds, an Identification Guide.* Boston, MA: Houghton Mifflin Company.

Harrison, P. 1987. *A Field Guide to Seabirds of the World.* Lexington, MA: Stephen Greene Press.

Hartwell, A.D. 1973. Classification and Relief Characteristics of Northern Alaska's Coastal Zone. Arctic 26(3):244-252.

Hashagen, K.A., G.A. Green, and B. Adams. 2009. Observations of Humpback Whales, *Megaptera novaeangliae*, in the Beaufort Sea, Alaska. Northwestern Nat. 90:160-162.

Heard, D.C. and T.M. Williams. 1991. Wolf Den Distribution on Migratory Barren-Ground Caribou Ranges in the Northwest Territories (Abstract). In C. Butler and S.P. Mahoney (Eds.), *Proceedings of the Fourth North American Caribou Workshop*. Paper presented at the Fourth North American Caribou Workshop, St John's, Newfoundland (pp. 249-250).

Helmers, D.L. 1992. *Shorebird Management Manual.* Manoment, MA: Wetlands for the Americas.

Hemming, J.E. 1971. The Distribution and Movement Patterns of Caribou in Alaska. Federal Aid in Wildlife Restoration Project W-17-R. *Wildlife Technical Bulletin No. 1.* Juneau, AK: State of Alaska, Department of Fish and Game.

Henshaw, J. 1968. The Activities of the Wintering Caribou in Northwestern Alaska in Relation to Weather and Snow Conditions. International Journal of Biometeorology 12:18-24.

Hess, N.A. and C.A. Ribic. 2000. Seabird ecology. In R.W. Davis, W.E. Evans and B. Würsig (Eds). *Cetaceans, Sea Turtles and Seabirds in the Northern Gulf of Mexico: Distribution, Abundance and Habitat Associations. Volume II: Technical Report.* USGS/BRD/CR-1999-0006 and OCS Study MMS 2000-003. USGS, Biological Resources Division and MMS, Gulf of Mexico OCS Region, New Orleans, LA.

Heyland, J.D. and K. Hay. 1976. An Attack by a Polar Bear on a Juvenile Beluga. Arctic 29:56-57.

Hine, A.C., G.R. Brooks, R.A. Davis, Jr., L.J. Doyle, G. Gelfenbaum, S.D. Locker, D.C. Twichell, and R.H. Weisberg. 2001. A Summary of Findings of the West-Central Florida Coastal Studies Project. U.S. Geological Survey Open File Report 01-303. Available online at: http://pubs.usgs.gov/of/2001/of01-303/index.html. Accessed November 5, 2015.

Hirth, H.F. 1997. Synopsis of the Biological Data on the Green Turtle, *Chelonia mydas* (Linnaeus 1758). Biological Report 97(1). Washington D.C.: U.S. Fish and Wildlife Service.

Hobbs, R.C., C.L. Sims, and K.E.W. Shelden. 2012. Estimated Abundance of Belugas in Cook Inlet, Alaska, from Aerial Surveys Conducted in June 2012. NMFS, NMML Unpublished Report.

Hollowell, G., E.O. Otis, and E. Ford. 2014. 2013 Lower Cook Inlet Area Finfish Management Report. Alaska Department of Fish and Game, Fishery Management Report No 14-30, Anchorage, AK.

Hollowell, G., E.O. Otis, and E. Ford. 2015. 2014 Lower Cook Inlet Area Finfish Management Report. Alaska Department of Fish and Game, Fishery Management Report No 15-32, Anchorage, AK.

Holmes, C.E. 2011. 10. The Beringian and Transitional Periods in Alaska: Technology of the East Beringian Tradition as Viewed from Swan Point. In T. Goebel and I. Buvit (Eds.), *From Yenisei to the Yukon: Interpreting Lithic Assemblage Variability in late Pleistocene/early Holocene Beringia*: (pp. 179-191). College Station, TX: Texas A&M University Press.

Hopcroft, R., B. Bluhm, and R. Gradinger (Eds.). 2008. Arctic Ocean Synthesis: Analysis of Climate Change Impacts in the Chukchi and Beaufort Seas with Strategies for Future Research, Institute of Marine Sciences, University of Alaska, Fairbanks, AK.

Hopkins, D.M. 1967. The Cenozoic History of Beringia: A Synthesis. In D.M. Hopkins (Ed.), *The Bering Land Bridge*. (pp 451-484). Stanford University Press, Stanford, CA.

Huntington, H.P. and L.T. Quakenbush. 2009. Traditional Knowledge of Bowhead Whale Migratory Patterns near Wainwright, Alaska. Final Report to the Wainwright Whaling Captains Associations, the Alaska Eskimo Whaling Commission, ConocoPhillips, Minerals Management Service, and the Coastal Marine Institute.

Irvine, J.R., R.W. Macdonald, R.J. Brown, L. Godbout, J.D. Reist, and E.C. Carmack. 2009. Salmon in the Arctic and How They Avoid Lethal Low Temperatures. North Pacific Anadromous Fish Commission Bulletin 5:39–50.

Jaquet, N. and D. Gendron. 2009. The Social Organization of Sperm Whales in the Gulf of California and Comparisons with Other Populations. J. Mar. Biol. Assoc. U.K. 89(5):975-983.

Jefferson, T.A. 2002. Clymene Dolphin *Stenella clymene*. In W.F. Perrin, B. Würsig and J.G.M. Thewissen (Eds.), *Encyclopedia of Marine Mammals*. (pp. 234-236). USA: Academic Press.

Jefferson, T.A. and A.J. Schiro. 1997. Distribution of Cetaceans in the Offshore Gulf of Mexico. Mammal Rev. 27(1):27-50.

Jefferson, T.A., S. Leatherwood, and M.A. Webber. 1993. *FAO Species Identification Guide. Marine Mammals of the World.* Rome, Italy: UNEP/FAO.

Jefferson, T.A., S. Leatherwood, and M.A. Webber. 2006. Marine Mammals of the World. Marine Species Identification Portal. Available online at: http://species-identification.org/species.php?species_group=marine_mammals&menuentry=soorten. Accessed on August 30, 2016.

Jefferson, T.A., M.A. Webber and R.L. Pitman. 2008. Marine Mammals of the World. Academic Press, London.

Jochens, A., D. Biggs, K. Benoit-Bird, D. Engelhaupt, J. Gordon, C. Hu, N. Jaquet, M. Johnson, R. Leben, B. Mate, P. Miller, J. Ortega-Ortiz, A. Thode, P. Tyack and B. Würsig. 2008. Sperm whale Seismic Study in the Gulf of Mexico: Synthesis report. OCS Study MMS 2008-006. MMS, Gulf of Mexico OCS Region, New Orleans, LA.

Johnson, J.H. and A.A. Wolman. 1984. The Humpback Whale: *Megaptera novaeangliae*. Marine Fisheries Review 46(4):30-37.

Johnson, S.R. 1993. An Important Early-Autumn Staging Area for Pacific Flyway Brant: Kasegaluk Lagoon, Chukchi Sea, Alaska. Journal of Field Ornithology 64(4):539–548.

Joung, D.J. and A.M. Shiller. 2013. Trace Element Distributions in the Water Column Near the Deepwater Horizon Well Blowout. Environ. Sci. Technol. 47:2161-2168.

Joye, S.B., I.R. MacDonald, I. Leifer, and V. Asper. 2011a. Magnitude and Oxidation Potential of Hydrocarbon Gases Released From the BP Oil Well Blowout. Nature Geoscience 4:160-164.

Joye, S.B., I. Leifer, I.R. MacDonald, J.P. Chanton, C.D. Meile, A.P. Teske, J.E. Kostka, L. Chistoserdova, R. Coffin, D. Hollander, M. Kastner, J.P. Montoya, G. Rehder, E. Solomon, T. Treude, and T.A. Villareal. 2011b. Comment on “A Persistent Oxygen Anomaly Reveals the Fate of Spilled Methane in the Deep Gulf of Mexico.” Science 332:1033c.

Kato, H. 2002. Bryde’s Whales *Balaenoptera edeni* and *B. brydei*. In W.F. Perrin et al. (Eds.), *Encyclopedia of Marine Mammals* (pp.171–177). San Diego, CA: Academic Press.

Kenai LNG Exports and Conoco Phillips. 2015. Extended Fact Sheet - Alaska. Available online at: http://alaska.conocophillips.com/Documents/Fact%20Sheet_Kenai%20LNG_CURRENT.pdf. Accessed on October 12, 2016.

Kerkvliet, C.M., M.D. Booz, and B.J. Failor. 2013. Recreational Fisheries in the Lower Cook Inlet Management Area, 2011–2013, with Updates for 2010. Fishery Management Report No 13-42. Anchorage, AK: Alaska Department of Fish and Game.

Kessler, J.D., D.L. Valentine, M.C. Redmond, and M. Du. 2011. Response to Comment on “A Persistent Oxygen Anomaly Reveals the Fate of Spilled Methane in the Deep Gulf of Mexico.” Science 332:1033d.

Khalil, S.M., C.W. Finkl, and R.C. Raynie. 2013. Development of New Restoration Strategies for Louisiana Barrier Island Systems, Northern Gulf of Mexico, USA. In D.C. Conley, G. Masselink, P.E. Russell, and T.J. O’Hare (Eds.), *Proceedings 12th International Coastal Symposium* (Plymouth, England), Journal of Coastal Research, Special Issue 65:1467-1472.

King, T. F. 2000. What Should Be the "Cultural Resources" Element of an EIA? Environmental Impact Assessment Review 20(1):5-30.

Kondzela, C., M. Garvin, R. Riley, J. Murphy, J. Moss, S.A. Fuller, and A. Gharrett. 2009. Preliminary Genetic Analysis of Juvenile Chum Salmon from the Chukchi Sea and Bering Strait. N. Pac. Anadr. Fish Comm. Bull. 5:25–27.

Kujawinski, E.B., M.C. Kido Soule, D.L. Valentine, A.K. Boysen, K. Longnecker, and M.C. Redmond. 2011. Fate of Dispersants Associated With the Deepwater Horizon Oil Spill. Environmental Science and Technology 45:1298–1306.

Kvitek, R.G., C.E. Bowlby, and M. Staedler. 1993. Diet and Foraging Behavior of Sea Otters in Southeast Alaska. Marine Mammal Science 9(2):168-181.

LaBrecque, E., C. Curtice, J. Harrison, S.M. Van Parijs, and P.N. Halpin. 2015. Biologically Important Areas for Cetaceans Within U.S. Waters-Gulf of Mexico Region. Aquatic Mammals 41(1):30-38.

Laidre, K.L., K.E.W. Shelden, D.J. Rugh, and B.A. Mahoney. 2000. Beluga, *Delphinapterus leucas*, Distribution and Survey Effort in the Gulf of Alaska. Marine Fisheries Review 62(3):27-36.

Larned, W.W. 2006. Winter Distribution and Abundance of Steller’s Eiders (*Polysticta stelleri*) in Cook Inlet, Alaska, 2004-2005. OCS Study MMS 2006-066. MMS, Alaska OCS Region, Anchorage, AK.

Larned, W.W. and D. Zwiefelhofer. 2001. Steller’s Eiders (*Polysticta stelleri*) in the Kodiak Archipelago, Alaska Jan.–Feb. 2001. Kodiak, AK: U.S. Fish and Wildlife Service.

Larned, W.W., R. Stehn, and R. Platte. 2006. Eider Breeding Population Survey Arctic Coast Plain, Alaska 2006. Anchorage, AK: U.S. Fish and Wildlife Service.

LaRoe, E.T. 1976. Barrier Islands as Significant Ecosystems. In J. Clark (Ed.), *Technical Proceedings of the 1976 Barrier Island Workshop.* Paper presented at the 1976 Barrier Island Workshop, Annapolis, MD (pp. 1-4). The Conservation Foundation.

LaSalle, M.W. 1998. Recognizing Wetlands in the Gulf of Mexico Region. Mississippi Cooperative Extension Service. Mississippi State University.

Lawhead, B.E. 1997. Caribou and Oil Development in Northern Alaska: Lessons from the Central Arctic Herd. In K.L. Mitchell (Project Coordinator) *NPR-A Symposium Proceedings, Science, Traditional Knowledge, and the Resources of the Northeast Planning Area of the National Petroleum Reserve-Alaska.* Apr. 15-18, 1997. OCS Report MMS-97-0013. BLM and MMS, Alaska OCS Region, Anchorage, AK.

Leatherwood, S. and R.R. Reeves. 1983. The Sierra Club Handbook of Whales and Dolphins. San Francisco, CA: Sierra Club Books.

Leatherwood, S., R.R. Reeves, W.F. Perrin, and W.E. Evans. 1982. Whales, Dolphins, and Porpoises of the Eastern North Pacific and Adjacent Arctic Waters: A Guide to Their Identification. U.S. Department of Commerce, NOAA Technical Report. NMFS Circular 444. 245 pp.

Leatherwood, S., T.A. Jefferson, J.C. Norris, W.E. Stevens, L.J. Hansen, and K.D. Mullin. 1993. Occurrence and Sounds of Fraser's Dolphin in the Gulf of Mexico. The Texas Journal of Science 45(4):349-354.

Lees, D.C. and W.B. Driskell. 2004. Annual Report for National Park Service Intertidal Reconnaissance Survey to Assess Composition, Distribution, and Habitat of Marine/Estuarine Infauna Inhabiting Soft Sediments in the Southwestern Alaska Network - Kenai Fjords National Park and Lake Clark National Park and Preserve. Prepared by Littoral Ecological & Environmental Services for Southwest Alaska Network, National Park Service.

Lees, D.C. and W.B. Driskell. 2006. Intertidal Reconnaissance Survey to Assess Composition, Distribution, and Habitat of Marine/Estuarine Infauna in Soft Sediments in the Southwest Alaska Network. Final Report. National Park Service-Southwest Alaska Network. Anchorage, AK.

Lefebvre, L.W., T.J. O'Shea, G.B. Rathbun, and R.C. Best. 1989. Distribution, Status, and Biogeography of the West Indian Manatee. In C.A. Wood (Ed.), *Biogeography of the West Indies.* (pp. 567-610). Gainesville, FL: Sandhill Crane Press, Inc.

Leffingwell, E. 1919. The Canning River Region Northern Alaska. Professional Paper No. 109. Washington, D.C.: U.S. Geological Survey.

Lent, P.C. 1966. The Caribou of Northwestern Alaska. In N.J. Wilimovsky and J. Wolfe (Eds.), Environment of the Cape Thompson Region, Alaska, Chapter 19. (pp. 481-516). Oak Ridge, TN: USDOC, Atomic Energy Commission, Div. of Technical Information.

Lent, P.C. 1980. Synoptic Snowmelt Patterns in Arctic Alaska in Relation to Caribou Habitat Use. In E. Reimers, E. Gaare and S. Skennsberg (Eds.), *Proceedings of the Second International Reindeer/Caribou Symposium, Roros, Norway, Sept.17-21, 1979.* Trondheim, Norway: Direktoratet for vilt og ferskvannsfisk.

Lentfer, J. and B. Small. 2008. Polar Bear. Alaska Department of Fish and Game. Available online at: https://www.adfg.alaska.gov/static/education/wns/polar_bear.pdf. Accessed on October 12, 2016.

Lentfer, J.W. and R.J. Hensel. 1980. Alaskan Polar Bear Denning. In C.J. Martinka and K.J. McArthur (Eds.), *Bears—Their Biology and Management: A Selection of Papers and Discussion from the Fourth Conference on Bear Research, Kalispell, Montana Feb. 1977*. (pp. 101-108). Tonto Basin, AZ: Bear Biology Association.

Lewis III, R. 1989. Creation and Restoration of Coastal Plain Wetlands in Florida. In J.A. Kusler and M.E. Kentula (Eds.), *Wetland Creation and Restoration: The Status of the Science, Volume I: Regional Reviews*. EPA 600/3-89/038a. (pp. 73-102). Corvallis, OR: U.S. Environmental Protection Agency.

Logerwell, E., M. Busby, C. Carothers, S. Cotton, J. Duffy-Anderson, E. Farley, P. Goddard, R. Heintz, B. Holladay, J. Horne, S. Johnson, B. Lauth, L. Moulton, D. Neff, B. Norcross, S. Parker-Stetter, J. Seigle, T. Sformo. 2015. Fish Communities across a Spectrum of Habitats in the Western Beaufort Sea and Chukchi Sea. Progress in Oceanography 136:115–132.

Louis Berger Group, Inc. 2004. OCS-Related Infrastructure in the Gulf of Mexico Fact Book. OCS Study MMS 2004-027. MMS, Gulf of Mexico OCS Region, New Orleans, LA.

Lovell, S., S. Steinback, and J. Hilger. 2013. The Economic Contribution of Marine Angler Expenditures in the United States, 2011. U.S. Department of Commerce, NOAA Tech. Memo. NMFS-F/SPO-134.

Lowry, L.F., J.J. Burns, and R.R. Nelson. 1987. Polar Bear, *Ursus maritimus*, Predation on Belugas, *Delphinapterus leucas*, in the Bering and Chukchi Seas. Canadian Field-Naturalist 101:141–146.

Lubchenco, J., M. McNutt, B. Lehr, M. Sogge, M. Miller, S. Hammond, and W. Conner. 2010. BP Deepwater Horizon Oil Budget: What Happened to the Oil?

Lytle, W.M. and F.R. Holdcamper. 1975. Merchant Steam Vessels of the United States 1790-1868 (The Lytle-Holdcamper List). Staten Island, NY: The Steamship Historical Society of America.

MacIntosh, R. 2009. Kodiak National Wildlife Refuge and Kodiak Island Archipelago: Birds. Kodiak, Alaska. U.S. Fish and Wildlife Service.

Maiaro, J.L. 2007. Disturbance Effects on Nekton Communities of Seagrasses and Bare Substrates in Biloxi Marsh, Louisiana (Doctoral Dissertation, Faculty of the Louisiana State University and Agricultural and Mechanical College in Partial Fulfillment of the Requirements for the Degree of Master of Science in The Department of Oceanography and Coastal Sciences by Jamie Lynn Maiaro BS, Louisiana State University).

Marine Log. 2014. Directory of U.S. and Canadian Shipyards. Available online at: http://www.shipbuildinghistory.com/today/statistics/directory.htm. Accessed December 15, 2015.

Marine Yellow Pages. 2015. Shipyards in the GOM. Available online at: http://www.marineyellowpages.com/index.php/gulf-states/menu-id-337. Accessed December 15, 2015.

Márquez, R. 1990. Sea Turtles of the World. An Annotated and Illustrated Catalogue of the Sea Turtle Species Known to Date. FAO Fisheries Synopsis 125(11). Food and Agricultural Organization of the United Nations, Rome.

Marx, R.F. 1987. Shipwrecks in the Americas. New York, NY: Dover Publications.

Mays, J.L. and D.J. Shaver. 1998. Nesting Trends of Sea Turtles in National Seashores along Atlantic and Gulf Coast Waters of the United States.

Maze-Foley, K. and K.D. Mullin. 2006. Cetaceans of the Oceanic Northern Gulf of Mexico: Distributions, Group Sizes and Interspecific Associations. J. Cetacean Res. Manage. 8(2):203-213.

MBC Applied Environmental Sciences. 2004. Proceedings of a Workshop on the Variability of Arctic Cisco (Qaaktaq) in the Colville River. OCS Study MMS 2004-033. MMS, Alaska OCS Region, Anchorage, AK.

McBride, R.A., S. Penland, M.W. Hiland, S.J. Williams, K.A. Westphal, B.J. Jaffe, and A.H. Sallenger. 1992. Analysis of Barrier Shoreline Change in Louisiana from 1853 to 1989. In S.J. Williams, S. Penland, and A.H. Sallenger (Eds.), *Atlas of Shoreline Changes in Louisiana from 1853 to 1989.* (pp. 36-97). U.S. Department of the Interior, Geological Survey. Miscellaneous Investigation Series I-2150-A.

McCammon, M., P. Mundy, and B. Spies. 2002. The Gulf of Alaska Ecosystem Monitoring and Research (GEM) Program Document, Exxon Valdez Oil Spill Trustee Council, July 9.

McDowell Group. 2015. Economic Impacts of Alaska’s Visitor Industry, 2013-14 Update. Prepared for the Alaska Department of Commerce, Community, and Economic Development – Division of Economic Development.

McWilliams, S.R. and W.H. Karasov. 2005. Migration Takes Guts: Digestive Physiology of Migratory Birds and its Ecological Significance. In P. Mara and R. Greenberg (Eds.), *Birds of Two Worlds.* (Ch. 6, pp 67-78). Washington, D.C.: Smithsonian Institution Press.

Michel, J., E.H. Owens, S. Zengel, A. Graham, Z. Nixon, T. Allard, W. Holton, P. D. Reimer, A. Lamarche, M. White, N. Rutherford, C. Childs, G. Mauseth, G. Challenger, and E. Taylor. 2013. Extent and Degree of Shoreline Oiling: Deepwater Horizon Oil Spill, Gulf of Mexico, USA. PLoS ONE. 8(6):e65087.

Middlebury Institute of International Studies at Monterey. 2015. Market Data. National Ocean Economics Program. Available online at: http://www.oceaneconomics.org/Market/ocean/oceanEcon.asp. Accessed September 2, 2015.

Mikkelsen, E. 1909. Conquering the Arctic Ice. George W. Jacobs and Co., Philadelphia, PA.

Miller, F.L., A. Gunn, and E. Broughton. 1985. Surplus Killing as Exemplified by Wolf Predation on Newborn Caribou. Canadian Journal Zoology 632:295-300.

MMS (Minerals Management Service). 1990. Alaska Outer Continental Shelf, Chukchi Sea Oil & Gas Lease Sale 126: Draft Environmental Impact Statement. Volume 2. OCS EIS/EA MMS 90-0035. MMS, Alaska OCS Region, Anchorage, AK.

Minerals Management Service. 1995. Alaska Outer Continental Shelf, Cook Inlet Planning Area: Oil and Gas Lease Sales 149: Final Environmental Impact Statement. Volume 2. OCS EIS/EA MMS 95-0066. MMS, Alaska OCS Region, Anchorage, AK.

Minerals Management Service. 1996. Cook Inlet Planning Area Oil and Gas Lease Sale 149: Final Environmental Impact Statement. OCS EIS/EA MMS 95-0066. Alaska OCS Region, Anchorage, AK.

Minerals Management Service. 2003a. Cook Inlet Planning Area Oil and Gas Lease Sales 191 and 199: Final Environmental Impact Statement. OCS EIS/EA MMS 2003-055. MMS, Alaska OCS Region, Anchorage, AK.

Minerals Management Service. 2003b. Alaska Outer Continental Shelf, Beaufort Sea Planning Area: Oil and Gas Lease Sales 186, 195, and 202: Final Environmental Impact Statement. Volume I. OCS EIS/EA MMS 2003-001. MMS, Alaska OCS Region, Anchorage, AK.

Minerals Management Service. 2007. Final Environmental Impact Statement for Oil and Gas Lease Sale 193, and Seismic Surveying Activities in the Chukchi Sea. OCS EIS/EA MMS 2007-026. MMS, Alaska OCS Region, Anchorage, AK.

Mizroch, A.A., D.W. Rice and J.M. Breiwick. 1984. The Fin Whale, *Balaenoptera physalus*. Mar. Fisheries Rev. 46:20-24.

Moore, S.E., J.M. Waite, L.L. Mazzuca, and R.C. Hobbs. 2000. Provisional Estimates of Mysticete Whale Abundance on the Central Bering Sea shelf. J. Cetacean Res. Manage. 2(3):227-234.

Morrison, R.I.G., R.K. Ross, and L.J. Niles. 2004. Declines in Wintering Populations of Red Knots in Southern South America. The Condor 106(1):60-70. University of California Press on behalf of the Cooper Ornithological Society.

Morrison, R.I.G., Y. Aubry, R.W. Butler, G.W. Beyersbergen, G.M. Donaldson, C.L. Gratto-Trevor, P.W. Hicklin, V.H. Johnston, and R.K Ross. 2001a. Declines in North American Shorebird Populations. Wader Study Group Bulletin 94:34-38.

Morrison, R.I.G., R.E. Gill, Jr., B.A. Harrington, S. Skagen, G.W. Page, C.L. Gratto-Trevor, and S.M. Haig. 2001b. Estimates of Shorebird Populations in North America. Occasional Paper No. 104, Canadian Wildlife Service, Ottawa, Ontario.

Morrison, R.I.G, B.J. McCaffery, R.E. Gill, S.K. Skagen, S.L. Jones, G.W. Page, C.L. Gratto-Trevor, and B.A. Andres. 2006. Population estimates of North American shorebirds, 2006. Wader Study Group Bulletin 111:67–85.

Morton, R.A. 2008. Historical Changes in the Mississippi-Alabama Barrier-Island Chain and the Roles of Extreme Storms, Sea Level, and Human Activities. Journal of Coastal Research 24(6):1587-1600. West Palm Beach, FL, ISSN 0749-0208.

Morton, R.A., T. Miller, and L.J. Moore. 2005. Historical Shoreline Changes along the US Gulf of Mexico: A Summary of Recent Shoreline Comparisons and Analyses. Journal of Coastal Research 22(4):704-709.

Moss, J.H., J.M. Murphy, E.V. Farley, Jr., L.B. Eisner, and A.G. Andrews. 2009. Juvenile Pink and Chum Salmon Distribution, Diet, and Growth in the Northern Bering and Chukchi Seas. North Pacific Anadromous Fish Commission Bulletin No. 5:191–196.

Mullin, K.D. 2007. Abundance of Cetaceans in the Oceanic Gulf of Mexico Based on 2003-2004 Ship Surveys. NMFS, Southeast Fisheries Science Center.

Mullin, K.D. and G.L. Fulling. 2004. Abundance of Cetaceans in the Oceanic Northern Gulf of Mexico, 1996-2001. Marine Mammal Science 20:78-807.

Mullin, K.D. and W. Hoggard. 2000. Visual Surveys of Cetaceans and Sea Turtles from Aircraft and Ships. In R. W. Davis, W. E. Evans and B. Würsig, (Eds.), *Cetaceans, Sea Turtles and Seabirds in the Northern Gulf of Mexico: Distribution, Abundance and Habitat Associations. Volume II: Technical Report.* (pp. 111-172). OCS Study MMS 96-0027. MMS, Gulf of Mexico OCS Region, New Orleans, LA.

Mullin, K.D., W. Hoggard and L.J. Hansen. 2004. Abundance and Seasonal Occurrence of Cetaceans in Outer Continental Shelf and Slope Waters of the North-Central and Northwestern Gulf of Mexico. Gulf of Mexico Science 2004(1):62-73.

Mullin, K., W. Hoggard, C. Roden, R. Lohoefener, C. Rogers and B. Taggart. 1991. Cetaceans on the Upper Continental Slope in the North-Central Gulf of Mexico. OCS Study/MMS 91-0027. MMS, Gulf of Mexico OCS Regional Office, New Orleans, LA.

Mullin, K., W. Hoggard, C. Roden, R. Lohoefener, C. Rogers and B. Taggart. 1994. Cetaceans on the Upper Continental Slope in the North-Central Gulf of Mexico. Fish. Bull. 92:773-786.

Musick, J.A., and C.J. Limpus. 1997. Habitat Utilization and Migration in Juvenile Sea Turtles. In P. L. Lutz and J. A. Musick (Eds.), *The Biology of Sea Turtles*. (pp. 137-164). Boca Raton, FL: CRC Press.

National Association of Pipe Coating Applicators. 2012. 2012 Pipeline and Gas Journal.

National Atlas. 2013. Profile of the People and Land of the United States. Available online at: http://nationalatlas.gov/articles/mapping/a_general.html. Accessed November 5, 2015.

National Commission (National Commission on the BP Deepwater Horizon Oil Spill and Offshore Drilling). 2011. The Use of Surface and Subsea Dispersants during the BP Deepwater Horizon Oil Spill. Staff working paper. No. 4.

NMFS (National Marine Fisheries Service). 1990. Public Review Draft Environmental Assessment/Regulatory Impact Review/Initial Regulatory Flexibility Analysis for the Arctic Fishery Management Plan and Amendment 29 to the Fishery Management Plan for Bering Sea/Aleutian Islands King and Tanner Crabs. January 2009. 379 pp.

NMFS. 1991. Draft Recovery Plan for the Humpback Whale (*Megaptera novaeangliae*). Silver Spring, MD.

NMFS. 2000. Status Review of Smalltooth Sawfish (*Pristis pectinata*).

NMFS. 2003. Endangered Species Act: Section 7 Consultation, Biological Opinion. Minerals Management Service. Oil and Gas Sales 191 and 199 Cook Inlet, Alaska Planning Area; and Authorization of Small Takes under the Marine Mammal Protection Act.

NMFS. 2008a. Conservation Plan for the Cook Inlet Beluga Whale (*Delphinapterus leucas*). Juneau, AK: National Marine Fisheries Service.

NMFS. 2008b. Recovery Plan for the Steller Sea Lion (*Eumetopias jubatus*). Revision. National Marine Fisheries Service, Silver Spring, MD.

NMFS. 2009a. Smalltooth Sawfish Recovery Plan (*Pristis pectinata*). Available online at: http://www.nmfs.noaa.gov/pr/pdfs/recovery/smalltoothsawfish.pdf. Accessed December 9, 2013.

NMFS. 2009b. Environmental Assessment/ Regulatory Impact Review/Final Regulatory Flexibility Analysis For the Arctic Fishery Management Plan And Amendment 29 to the Fishery Management Plan for Bering Sea/Aleutian Islands King and Tanner Crabs.

NMFS. 2010. Status Review of the Largetooth Sawfish (*Pristis perotteti*).

NMFS. 2011a. Deaths of Ringed Seals in Alaska Declared an Unusual Mortality Event; Walrus Pending. Available online at: https://alaskafisheries.noaa.gov/node/3770. Accessed December 15, 2015.

NMFS. 2011b. Green Turtle (*Chelonia mydas*). Available online at: http://www.nmfs.noaa.gov/pr/species/turtles/green.html#threats. Accessed December 15, 2015.

NMFS. 2011c. Loggerhead Turtle (*Caretta caretta*). Available online at: http://www.nmfs.noaa.gov/pr/species/turtles/loggerhead.html. Accessed December 15, 2015.

NMFS. 2013. Northern Pinniped Unusual Mortality Event (UME) Update March/April 2013.

NMFS. 2014a. Northern Pinnipeds Unusual Mortality Event: Update May 2014. Available online at: https://alaskafisheries.noaa.gov/sites/default/files/ume_factsheet0514.pdf. Accessed October 12, 2016.

NMFS. 2014b. Fisheries Economics of the United States, 2012. Economics and Sociocultural Status and Trend Series. NOAA Technical Memorandum NMFS-F/SPO-137.

NMFS. 2015a. Protected Species Glossary. Available online at: http://www.nmfs.noaa.gov/pr/glossary.htm#strategic. Accessed December 15, 2015.

NMFS. 2015b. Status of Marine Mammals. Available online at: http://www.nmfs.noaa.gov/pr/species/mammals/#status. Accessed August 15, 2016.

NMFS. 2015c. Cetacean Unusual Mortality Event in Northern Gulf of Mexico (2010-present). Available online at: http://www.nmfs.noaa.gov/pr/health/mmume/cetacean_gulfofmexico.htm. Accessed December 15, 2015.

NMFS. 2015d. Cetacean Unusual Mortality Event in Northern Gulf of Mexico Investigation Results. Available online at: http://www.nmfs.noaa.gov/pr/health/mmume/cetacean_gulfofmexico_results.html. Accessed December 15, 2015.

NMFS. 2015e. 2011-2012 Bottlenose Dolphin Unusual Mortality Event in Texas. Available online at: http://www.nmfs.noaa.gov/pr/health/mmume/bottlenosedolphins_texas.htm. Accessed December 15, 2015.

NMFS. 2015f. FAQs on the Ongoing Gulf of Mexico Dolphin Die-Off. Available online at: http://www.nmfs.noaa.gov/pr/health/mmume/cetacean_gulfofmexico_faq.htm. Accessed December 15, 2015.

NMFS. 2015g. Scientists Report Some Gulf Dolphins are Gravely Ill. Available online at: http://www.nmfs.noaa.gov/stories/2013/12/12_18_13gulf_dolphin_study.html. Accessed December 15, 2015.

NMFS. 2015h. Alaska Fisheries Science Center.

NMFS. 2015i. Commerical Fisheries Statistics. Available online at: https://www.st.nmfs.noaa.gov/commercial-fisheries/commercial-landings/. Accessed August 17, 2016.

NMFS. 2016. Part 622-Fisheries of the Caribbean, Gulf of Mexico, and South Atlantic.

NMFS (National Marine Fisheries Service) and USFWS (U.S. Fish and Wildlife Service). 2007a. Green Sea Turtle (*Chelonia mydas*) 5-Year Review: Summary and Evaluation. Silver Spring, MD and Jacksonville, FL.

NMFS and USFWS. 2007b. Kemp’s Ridley Sea Turtle (Lepidochelys kempii) 5-Year Review: Summary and Evaluation. Silver Spring, MD and Albuquerque, NM.

NMFS and USFWS. 2008. Recovery Plan for the Northwest Atlantic Population of the Loggerhead Sea Turtle (*Caretta caretta*), Second Revision. Available online at: http://www.nmfs.noaa.gov/pr/pdfs/recovery/turtle_loggerhead_atlantic.pdf. Accessed December 15, 2015.

NMFS and USFWS. 2013a. Hawksbill Sea Turtle (*Eretmochelys imbricata*). 5-Year Review: Summary and Evaluation. Available online at: http://www.fws.gov/northflorida/SeaTurtles/Docs/2013_hawksbill_sea_turtle_ESA_5-year_Status_Review_FINAL.pdf. Accessed December 15, 2015.

NMFS and USFWS. 2013b. Leatherback Sea Turtle (*Dermochelys coriacea*). 5-Year Review: Summary and Evaluation. Available online at: http://www.fws.gov/northflorida/SeaTurtles/Docs/2013_leatherback_sea_turtle_ESA_5-year_status_review_FINAL.pdf. Accessed December 15, 2015.

NMFS, USFWS, and SEMARNAT. 2010. BiNational Recovery Plan for the Kemp’s Ridley Sea Turtle (*Lepidochelys kempii*), Second Revision. National Marine Fisheries Service. Silver Spring, Maryland.

National Marine Protected Areas Center. 2008. State of the Nation’s de Facto Marine Protected Areas, R. Grober-Dunsmore and L. Wooninck (Eds.), Silver Spring, MD.

NOS (National Ocean Service), NOAA. 2008. Gulf of Mexico at a Glance.

NOAA, ORR (National Oceanic and Atmospheric Administration, Office of Response and Restoration). 2015. National ESI Shoreline Maps. Available online at: http://response.restoration.noaa.gov/maps-and-spatial-data/download-esi-maps-and-gis-data.html. Accessed December 16, 2015.

NOAA (National Oceanic and Atmospheric Administration). 2002. Cook Inlet and Kenai Peninsula, Alaska. Environmentally Sensitive Areas: Winter (December-March).

NOAA. 2012. NOAA's State of the Gulf.

NOAA. 2013. Effects of oil and gas activities in the Arctic Ocean. Supplemental Draft Environmental Impact Statement. Prepared by USDOC, NMFS, Office of Protected Resources.

NPS (National Park Service). 2015. Padre Island National Seashore Map.

NatureServe. 2015. NatureServe Explorer: An Online Encyclopedia of Life. NatureServe, Arlington, VA. Available online at: http://explorer.natureserve.org/index.htm. Accessed May 8, 2015.

Nelson, M. 2008b. Spotted Seal. Alaska Department of Fish and Game. Available online at: http://www.adfg.alaska.gov/static/education/wns/spotted_seal.pdf. Accessed October 12, 2016.

Normandeau Associates, Inc. 2011. New Insights and New Tools Regarding Risk to Roseate Terns, Piping Plovers, and Red Knots from Wind Facility Operations on the Atlantic Outer Continental Shelf. Final Report. BOEMRE 2011-048. BOEMRE, Herndon, VA.

NPFMC and NMFS (North Pacific Fishery Management Council and National Marine Fisheries Service). 1990. Fishery Management Plan for the Salmon Fisheries in the EEZ off the Coast of Alaska, Alaska Region.

NPFMC. 2009. Fishery Management Plan for Fish Resources of the Arctic Management Area.

NPFMC. 2012. Fishery Management Plan for the Salmon Fisheries in the EEZ off the Coast of Alaska, Alaska Region.

NPFMC. 2014. Fishery Management Plan for the Scallop Fishery off Alaska.

NPFMC. 2015a. North Pacific Fishery Management Council Home Page. Available online at: http://www.fakr.noaa.gov/npfmc/index.html. Accessed August 15, 2015.

NPFMC. 2015b. Fishery Management Plan for Groundfish of the Gulf of Alaska. August 2015. 130 pp.

NPFMC. 2015c. Gulf of Alaska Crab Bycatch. Available online at: http://www.npfmc.org/crab-bycatch-overview/gulf-of-alaska-crab-bycatch/ . Accessed August 15, 2015.

Nuttall, M. 2012. Encyclopedia of the Arctic Volumes 1, 2 and 3, Routledge.

Odell, D.K. and K.M. McClune. 1999. *Pseudorca crassidens* (Owen, 1846) In: S.H. Ridgway and S.R. Harrison (Eds.), *Handbook of Marine Mammals Vol. 6: The Second Book of Dolphins and Porpoises*. (pp. 213-244).

Omura, H. 1959. Bryde's whales from the coast of Japan. Scientific Reports of the Whales Research Institute, Tokyo 14:l-33.

OSAT (Operational Science Advisory Team). 2010. Summary Report for Sub-Sea and Sub-Surface Oil and Dispersant Detection: Sampling and Monitoring. Unified Area Command, New Orleans, LA.

O'Sullivan, S. and K.D. Mullin. 1997. Killer Whales (*Orcinus orca*) in the Northern Gulf of Mexico. Mar. Mamm. Sci. 13(1):141-147.

Ortega Ortiz, J.G. 2002. Multiscale Analysis of Cetacean Distribution in the Gulf of Mexico. Ph.D. thesis. Texas A&M University.

Otvos, E.G. and G.A. Carter. 2008. Hurricane Degradation—Barrier Development Cycles, Northeastern Gulf of Mexico: Landform Evolution and Island Chain History. Journal of Coastal Research 24(2):463-478.

Paine, J.G., T. Caudle, and J. Andrews. 2014. Historical to Recent Texas Gulf Shoreline Movement and its Postglacial Context. 2014 Geological Society of America (GSA) Annual Meeting in Vancouver, BC (19-22 October 2014).

Parker-Stetter, S.L., J.K. Horne, and T.J. Weingartner. 2011. Distribution of Polar Cod and Age-0 Fish in the U.S. Beaufort Sea. Polar Biology 34:1543–1557.

Patel, S. 2010. Wave Energy Device to Tap Marine Energy in Gulf of Mexico, Power Magazine. Available online at: http://www.powermag.com/wave-energy-device-to-tap-marine-energy-in-gulf-of-mexico/. Accessed December 15, 2015.

Paul, J.H., D. Hollander, P. Coble, K.L. Daly, S. Murasko, D. English, J. Basso, J. Delaney, L. McDaniel, and C.W. Kovach. 2013. Toxicity and Mutagenicity of Gulf of Mexico Waters during and After the Deepwater Horizon Oil Spill. Environ. Sci. Technol. 47:9651-9659.

Pauly, D, R. Watson and J. Alder. 2005. Global trends in world fisheries: impacts on marine ecosystems and food security. Philosophical Transactions of the Royal Society: Biological Sciences 360: 5-12.

Pearson, C.E., D.B. Kelley, R.A. Weinstein, and S.W. Gagliano. 1986. Archaeological Investigations on the Outer Continental Shelf: A Study within the Sabine River Valley, Offshore Louisiana and Texas. OCS Study MMS 86-0119. MMS, Headquarters, Reston, VA.

Pearson, C.E., S.R. James, Jr., M.C. Krivor, S.D. El Darragi, and L. Cunningham. 2003. Refining and Revising the Gulf of Mexico Outer Continental Shelf Region High-Probability Model for Shipwrecks: Final Report. Volume II: Technical Narrative. OCS Study MMS 2003-061. MMS, Gulf of Mexico OCS Region, New Orleans, LA.

Perry, C.L. and I.A. Mendelssohn. 2009. Ecosystem Effects of Expanding Populations of *Avicennia germinans* in a Louisiana Salt Marsh. Wetlands. 29(1):396-406.

Perry, S.L., D.P. DeMaster, and G.K. Silber. 1999. The Fin Whale. In The Great Whales: History and Status of Six Species Listed as Endangered Under the U.S. Endangered Species Act of 1973. Marine Fisheries Review 61(1): 44-51.

Perryman, W.L. 2002. Melon-Headed Whale *Peponocephala electra* (Gray, 1846). Pages 733– 734 in W. F. Perrin, B. Wursig, and J. G. M. Thewissen, eds. Encyclopedia of Marine Mammals. Academic Press, San Diego, CA.

Peterson, R.T. 1980. Peterson Field Guides – Eastern birds. New York, NY: Houghton Mifflin Company.

Phillips, R.L., T.E. Reiss, E. Kempema, and E. Reimnitz. 1984. Near Shore Marine Geologic 40 Investigations, Wainwright to Skull Cliff, Northeast Chukchi Sea, U.S. Geological Survey Open- 41 File Report 84-108.

Philo, L.M., G.M. Carroll, and D.A. Yokel. 1993. Movements of Caribou in the Teshekpuk Lake Herd as Determined by Satellite Tracking. Barrow, AK: North Slope Borough.

Piatt, J.F., J. Wetzel, K. Bell, A.R. DeGange, G.R. Balogh, G.S. Drew, T. Greernaert, C. Ladd, and G.V. Byrd. 2006. Predictable Hotspots and Foraging Habitat of the Endangered Short-tailed Albatross (*Phoebastria albatrus*) in the North Pacific: Implications for Conservation. Deep Sea Research II, 53:387–398.

Poirrier, M.A. and L.R. Handley. 1940. Chandeleur islands. Seagrass Status and Trends in the Northern Gulf of Mexico: 1940-2002.

Port of Dutch Harbor, Unalaska, Convention & Visitors Bureau. 2015. Available online at: http://www.unalaska.info/visitors/where-to-stay. Accessed October 12, 2016.

Potter, B.A., P.J. Gilbert, C.H. Holmes, and B.A. Crass. 2011. The Mead Site: A Late Pleistocene/Holocene Stratified Site in Central Alaska. Current Research in the Pleistocene 28:73-75.

Powers, K. 1987. Seabirds. In J.D. Milliman and W.R. Wright (Eds.), The Marine Environment of the U.S. Atlantic Continental Slope and Rise. (pp. 194-201). Boston/Woods Hole, MA: Jones and Bartlett Publ., Inc.

Quakenbush, L.T. and H.P. Huntington. 2010. Traditional Knowledge Regarding Bowhead Whales in the Chukchi Sea near Wainwright, Alaska. OCS Study MMS 2009-063. Coastal Marine Institute, University of Alaska, Fairbanks, AK.

Quakenbush, L.T., J.J. Citta, J.C. George, R.J. Small, and M.P. Heide-Jørgensen. 2010. Fall and winter Movements of Bowhead Whales (*Balaena mysticetus*) in the Chukchi Sea and Within a Potential Petroleum Development Area. Arctic 63:289-307.

Rappole, J.H. 1995. The Ecology of Migrant Birds: A Neotropical Perspective. Washington, D.C.: Smithsonian Inst. Press.

Rathbun, G.B., R.K. Bonde, and D. Clay. 1982. The Status of the West Indian Manatee on the Atlantic Coast North of Florida. In R.R. Odom and J.W. Guthrie, (Eds.), *Proceedings, Symposium on Nongame and Endangered Wildlife. Technical Bulletin WL5.* (pp. 152–164). Social Circle, GA: Georgia Department of Natural Resources, Game and Fish Division.

Reddy, C.M., J.S. Arey, J.S. Seewald, S.P. Sylva, K.L. Lemkau, R.K. Nelson, C.A. Carmichael, C.P. McIntyre, J. Fenwick, G.T. Ventura, B.A.S. Van Mooy, and R. Camilli. 2011. Composition and Fate of Gas and Oil Released To The Water Column During the Deepwater Horizon Oil Spill. Proceedings of the National Academy of Sciences (PNAS).

Reeves, R.R. and H. Whitehead. 1997. Status of Sperm Whale, *Physeter macrocephalus*, in Canada. Can. Field Nat. 111:293-307.

Reeves, R.R., G.K. Silber, and P.M. Payne. 1998. Draft Recovery Plan for the Fin Whale, *Balaenoptera physalus*, and Sei Whale, *Balaenoptera borealis*. Office of Protected Resources, National Marine Fisheries Service, NOAA, Silver Spring, MD.

Regehr, E.V., S.C. Amstrup, and I. Stirling. 2006. Polar Bear Population Status in the Southern Beaufort Sea: U.S. Geological Survey Open-File Report 2006-1337.

Reimers, E. 1980. Activity Pattern: The Major Determinant for Growth and Fattening in Rangifer. In E. Reimers, E. Gaare and S. Skjennsberg, (Eds.), *Proceedings of the Second International Reindeer/Caribou Symposium, Roros, Norway*. Trondheim, Norway: Direktoratet for vilt og ferskvannsfisk.

Rendell, L.E. and H. Whitehead. 2001. Culture in Whales and Dolphins. Behav. Brain Sci. 24:309-382.

Rendell, L. and H. Whitehead. 2003. Vocal Clans in Sperm Whales (*Physeter macrocephalus*). Proc. R. Soc. Lond. (Biol) 270:225-231.

Rendell, L., S.L. Mesnick, M.L. Dalebout, J. Burtenshaw, and H. Whitehead. 2011. Can Genetic Bromaghin Differences Explain Vocal Dialect Variation in Sperm Whales, *Physeter microcephalus*? Behavior Genetics 42:332-343.

Reynolds, C.R. 1993. Gulf Sturgeon Sightings, Historic and Recent - A Summary of Public Responses. U.S. Fish and Wildlife Service. Panama City, FL.

Ribic, C.A., R. Davis, N. Hess, and D. Peake. 1997. Distribution of Seabirds in the Northern Gulf of Mexico in Relation to Mesoscale Features: Initial Observations. Jour. Mar. Sci. 54:545-551.

Rice, D.W., and A.A. Wolman. 1971. The Life History and Ecology of the Gray Whale, *Eschrichtius robustus*. Am. Soc. Mammal. Special Publication 3.

Rice, D.W. and A.A. Wolman. 1982. Whale Census in the Gulf of Alaska, June to August 1980. Reports to the International Whaling Commission 32:491-498.

Richter, C., J. Gordon, N. Jaquet and B. Würsig. 2008. Social Structure of Sperm Whales in the Northern Gulf of Mexico. Gulf Mex. Sci. 26(2):118-123.

Riedman, M.L. and J.A. Estes. 1990. The Sea Otter (*Enydra lutris*): Behavior, Ecology, and Natural History. U.S. Department of the Interior, U.S. Fish and Wildlife Service. Biological Report 90(14). Washington D.C.

Riedman, M.L., J.A. Estes, M.M. Staedler, A.A. Giles, and D.R. Carlson. 1994. Breeding Patterns and Reproductive Success of California Sea Otters. J. Wildl. Manage. 58:391-399.

Roach, E.R., M.C. Watzin, J.D. Scurry, and J.B. Johnston. 1987. Wetland Trends in Coastal Alabama. In T.A. Lowery (Ed.), *Symposium on the Natural Resources of the Mobile Bay Estuary, MASGP-87-007*. (pp. 92–101). Alabama Sea Grant Extension Service, Auburn University, Auburn, AL.

Roby, D.D. 1980. Winter Activity of Caribou on Two Arctic Ranges. In R. Reimers, E. Gaare, and S. Skjensberg, (Eds.), *Proceedings of the Second International Reindeer/Caribou Symposium, Roros, Norway*. (pp. 537-543). Norsk Direktorat for Wilt og Freskvannsfisk.

Rogers, J. 2012. Archaeological Assessment of Geotechnical Cores and Materials, 2011 Statoil Ancillary Activities, Chukchi Sea, Alaska. Report submitted to Statoil USA E&P, Inc., Anchorage, AK.

Romero, A., A.I. Agudo, S.M. Green, and G. Notarbartolo Di Sciara. 2001. Cetaceans of Venezuela: Their Distribution and Conservation Status. NOAA Technical Report NMFS- 151. Seattle, WA.

Roth, A.F. 2009. Anthropogenic and Natural Perturbations on Lower Barataria Bay, Louisiana: Detecting Responses of Marsh-Edge Fishes and Decapod Crustaceans. Dissertation. Louisiana State University, Baton Rouge, LA.

Rozell, N. 2000. The Search for Russia's Lindburgh, Alaska Science Forum, September 10, 1999, Article #1456, University of Alaska, Fairbanks Geophysical Institute. Available online at: http://www2.gi.alaska.edu/ScienceForum/ASF14/1456.html. Accessed October 2, 2014.

Rugh, D., J. Breiwick, R. Hobbs, K., Shelden and M. Muto. 2007. Eastern North Pacific Gray Whale Abundance in the Winter of 2006-2007. Report of the International Whaling Commission. Scientific Committee. SC/60/BRG6.

Rugh, D.J., K.E.W. Shelden, and R.C. Hobbs. 2010. Range Contraction in a Beluga Whale Population. Endang. Species Res. 12:69-75.

Rugh, D.J., K.E.W. Shelden, C.L. Sims, B.A. Mahoney, B.K. Smith, L.K. Litzky, and R.C. Hobbs. 2005. Aerial Surveys of Belugas in Cook Inlet, Alaska, June 2001, 2002, 2003, and 2004. U.S. Department of Commerce, NOAA Tech. Memo. NMFS-AFSC-149.

Russ, E., C.E. Trowbridge, and C. Russ. 2013. Cook Inlet Area Groundfish Management Report 2005–2011.

Russell, R.W. 2005. Interactions between Migrating Birds and Offshore Oil and Gas Platforms in the Northern Gulf of Mexico: Final Report. OCS Study MMS 2005-009. MMS, Gulf of Mexico OCS Region, New Orleans, LA.

Sammarco, P.W., S.R. Kolian, R.A. Warby, J.L. Bouldin, W.A. Subra, and S.A. Porter. 2013. Distribution and Concentrations of Petroleum Hydrocarbons Associated With the BP/Deepwater Horizon Oil Spill, Gulf of Mexico. Marine Pollution Bulletin 73(1):129-143.

Scarff, J.E. 1986. Historic and Present Distribution of the Right Whale (*Eubalaena glacialis*) in the Eastern North Pacific South of 50°N and East of 180°W. International Whaling Commission Report, Special Issue 10:43-63.

Schliebe, S.L., T.J. Evans, S. Miller, C. Perham, and L. Lierheimer. 2005. Summary of Polar Bear Management in Alaska, 2000-2004. In *Polar bears: Proceedings of the 14th Working Meeting of the IUCN/SSC Polar Bear Specialist Group, 20-24 June, 2005.* (pp. 63–76). Seattle, WA.

Schreiber, E.A. and J. Burger. 2002. Seabirds in the Marine Environment. In Schreiber, E.A. and J. Burger (Eds.), *Biology of marine birds.* (pp. 1-15). Boca Raton, FL: CRC Press.

Schwartz, F.J. 1995. Florida Manatees, *Trichechus manatus* (Sirenia: Trichechidae), in North Carolina 1919–1994. Brimleyana 22:53–60.

Sergeant, D.E., and P.F. Brodie. 1969. Body Size in White Whales, *Delphinapterus leucas*. J. Fish. Res. Bd. Can. 26:2561-2580.

Sexson, M.G., J.M. Pearce, and M.R. Petersen. 2014. Spatiotemporal Distribution and Migratory Patterns of Spectacled Eiders. OCS Study, BOEM 2014-665. U.S. Department of the Interior, U.S. Geological Survey Alaska Science Center. Anchorage, AK.

Shealer, D. 2002. Foraging Behavior and Food of Seabirds. In E.A. Schreiber and J. Burger (Eds.), *Biology of Marine Birds.* (pp. 137-177). Boca Raton, FL: CRC Press.

Shelden, K.E.W., D.J. Rugh, B.A. Mahoney, and M.E. Dahlheim. 2003. Killer Whale Predation on Belugas in Cook Inlet, Alaska: Implications for a Depleted Population. Marine Mammal Science 19(3):529-544.

Shelden, K.E.W., S.E. Moore, J.M. Waite, P.R. Wade D.J. and Rugh. 2005. Historic and Current Habitat Use by North Pacific Right Whales, *Eubalaena japonica*, in the Bering Sea and Gulf of Alaska. Mammal Rev. 35:129-155.

Sherwood C.R., J.W. Long, P.J. Dickhudt, P. Soupy Dalyander, D.M. Thompson, and N.G. Plant. 2014. Inundation of a Barrier Island (Chandeleur Islands, Louisiana, USA) During a Hurricane: Observed Water-Level Gradients and Modeled Seaward Sand Transport. Journal of Geophysical Research 119(7):1498-1515.

Shields, P. and A. Dupuis. 2015. Upper Cook Inlet Commercial Fisheries Annual Management Report, 2014. Alaska Department of Fish and Game, Fishery Management Report No. 15-20, Anchorage, AK.

Shillinger, G.L., D.M. Palacios, H. Bailey, S.J. Bograd, A.M. Swithenbank, P. Gaspar, B.P Wallace, J.R. Spotila, F.V. Paladino, R. Piedra, S.A. Eckert, and B.A. Block. 2008. Persistent Leatherback Turtle Migrations Present Opportunities for Conservation. PLoS Biol 6(7):e171.

Short, F.T., D.M. Burdick, C.A. Short, R.C. Davis, and P.A. Morgan. 2000. Developing Success Criteria for Restored Eelgrass, Salt Marsh and Mud Flat Habitats. Ecological Engineering 15(3):239-252.

Sibley, D.A. 2000. The Sibley Guide to Birds. National Audubon Society. New York, NY: Alfred A. Knopf.

Simpfendorfer, C.A. 2006. Population Viability Analysis of the Smalltooth Sawfish in U.S. waters. Final report. Mote Technical Report; Number 1135.

Simpfendorfer, C.A. and T.R. Wiley. 2005. Determination of the Distribution of Florida's Remnant Sawfish Population and Identification of Areas Critical to their Conservation. Final Report to the Florida Fish and Wildlife Conservation Commission, Tallahassee, FL.

Society for Sedimentary Geology. 2013. Major Depositional Settings of Barrier Island Systems. Available online at: http://www.sepmstrata.org/page.aspx?pageid=300. Accessed February 2, 2015.

Spier, C., W.T. Stringfellowa, T.C. Hazen, and M. Conrad. 2013. Distribution of Hydrocarbons Released During the 2010 MC252 Oil Spill in Deep Offshore Waters. Environmental Pollution 173:224-230.

Stabile, J., J.R. Waldman, F. Parauka, and I. Wirgin. 1996. Stock Structure and Homing Fidelity in Gulf of Mexico Sturgeon (*Acipenser oxyrinchus desotoi*) Based on Restriction Fragment Length Polymorphism and Sequence Analyses of Mitochondrial DNA. Genetics 144(2):767-775.

Stacey, P.J. and R.W. Baird. 1991. Status of the Pacific White-Sided Dolphin, *Lagenorhynchus obliquidens*, in Canada. Canadian Field-Naturalist 105(2):218-232.

Stacey, P.J., S. Leatherwood, and R.W. Baird. 1994. *Pseudorca crassidens*. Mammal Species 456:1-6.

State of Alaska. 2015. Division of Spill Prevention and Response. Available online at: http://dec.alaska.gov/spar/perp/plans/scp_ns.htm. Accessed August 28, 2015.

Stedman, S.M. and T.E. Dahl. 2008. Status and Trends of Wetlands in the Coastal Watersheds of the Eastern United States, 1998 to 2004. National Oceanic and Atmospheric Administration, National Marine Fisheries Service.

Stephenson, S.A. 2005. The Distribution of Pacific Salmon (*Oncorhynchus* spp.) in the Canadian Western Arctic. Can. Manuscr. Rep. Fish. Aquat. Sci. 2737: vi + 29p.

Stevenson, D., L. Chiarella, D. Stephan, R. Reid, K. Wilhelm, J. McCarthy, and M. Pentony. 2004. Characterization of the Fishing Practices and Marine Benthic Ecosystems of the Northeast U.S. Shelf, and an Evaluation of the Potential Effects of Fishing on Essential Fish Habitat. NOAA Technical Memorandum NMFS-NE; 181.

Stewart, B.E. and R.E.A. Stewart. 1989. Mammalian Species, *Delphinapterus leucas*. The American Society of Mammologists. 336:1-8.

Stirling, I. and E.H. McEwan. 1975. The Caloric Value of Whole Ringed Seals (*Phoca hispida*) in Relation to Polar Bear (*Ursus maritimus*) Ecology and Hunting Behavior. Can. J. Zool. 53:1021-1027.

Stirling, I. and P. Latour. 1978. Comparative Hunting Abilities of Polar Bear Cubs of Different Ages. Canadian J. Zool. 56:1768-1772.

Stirling, I. and W.R. Archibald. 1977. Aspects of Predation of Seals by Polar Bears. J. Fish. Res. Board Can. 34:1126-1129.

Stright, M.J., E.M. Lear, and J.F. Bennett. 1999. Spatial Data Analysis of Artifacts Redeposited by Coastal Erosion: A Case Study of McFaddin Beach, Texas. OCS Study MMS 99-0068. MMS, Headquarters, Herndon, VA.

Stucker, J.H. and F.J. Cuthbert. 2006. Distribution of Non-Breeding Great Lakes Piping Plovers along Atlantic and Gulf of Mexico coastlines: 10 Years of Band Resightings. A report to the U.S. Department of the Interior, U.S. Fish and Wildlife Service.

Suburban Stats. 2015. Internet website: https://suburbanstats.org/population/alaska/list-of-counties-and-cities-in-alaska. Accessed August 28, 2015.

Sulak, K. J. and J. P. Clugston. 1999. Recent Advances in Life History of Gulf of Mexico Sturgeon, *Acipenser oxyrinchus desotoi*, in the Suwannee River, Florida, USA: a synopsis. Journal of Applied Ichthyology 15.4-5:116-128.

Sulak, K.J., R.E. Edwards, G.W. Hill, and M.T. Randall. 2002. Why do Sturgeons Jump? Insights from Acoustic Investigations of the Gulf Sturgeon in the Suwannee River, Florida, USA. Journal of Applied Ichthyology 18(4-6):617-620.

Taylor, M., T. Larsen, and R.E. Schweinsburg. 1985. Observations of Intraspecific Aggression and Cannibalism in Polar Bears (*Ursus maritimus*). Arctic 38:303-309.

Tesoro Corporation. 2015. Kenai Refinery Fact Sheet. Available online at: https://tsocorpsite.files.wordpress.com/2015/06/tesoro-kenai-fact-sheet.pdf. Accessed October 12, 2016.

Texas Parks and Wildlife. 2015. Whooping Crane (*Grus Americana).* Available online at: https://tpwd.texas.gov/huntwild/wild/species/whooper/. Accessed May 13, 2015.

Thompson, D.C. and K.J. McCourt. 1981. Seasonal Diets of the Porcupine Caribou Herd. American Midland Naturalist 1051:70-76.

Tornfelt, E.E. and M. Burwell. 1992. Shipwrecks of the Alaskan Shelf and Shore. OCS Study MMS 92-0002. MMS, Alaska OCS Region, Anchorage, AK.

Townsend, C.H. 1935. The Distribution of Certain Whales as Shown by Logbook Records of American Whale Ships. Zoologica 19:1-50.

Trowbridge, C.E. and K.J. Goldman. 2006. 2006 Review of Cook Inlet Area Commercial Fisheries for Dungeness Crab, Shrimp, and Miscellaneous Shellfish Fisheries: A Report to the Alaska Board of Fisheries. Alaska Department of Fish and Game, Special Publication No. 06-09, Anchorage, AK.

Trowbridge, C.E., W.R. Dunne, M.A. Lambdin, M.M. Byerly, and K.J. Goldman. 2008. Cook Inlet Area Groundfish Management Report 1996–2004. Alaska Department of Fish and Game, Fishery Management Report No. 08-06, Anchorage, AK.

Tynan, C.T., D. P. DeMaster, and W.T. Peterson. 2001. Endangered Right Whales on the Southeastern Bering Sea Shelf. Science 294:1894.

U.S. Army Corps of Engineers. 2010. Navigation Data Center: U.S. Waterborne Container Traffic by Port/Waterway in 2009. Available online at: http://www.ndc.iwr.usace.army.mil/wcsc/by_porttons09.html. Accessed July 27, 2015.

U.S. Census Bureau. 2011. Population 33 U.S. Census Bureau, Statistical Abstract of the United States: 2012 Table 26. States with Coastal Counties—Population, Housing Units.

U.S. Census Bureau. 2012. Annual Estimates of the Resident Population for Incorporated Places of 50,000 or More, Ranked by July 1, 2013 Population: April 1, 2010 to July 1, 2013 - United States -- Places of 50,000+ Population.

U.S. Census Bureau. 2013. 2009-2013 5-Year American Community Survey, DP03 - Selected Economic Characteristics.

U.S. Coast Guard. 2015. Environmental Assessment U.S. Coast Guard Arctic Training Activities. April 2015.

U.S. Committee on the Marine Transportation System. 2013. U.S. Arctic Marine Transportation System: Overview and Priorities for Action. July 30, 2013.

USDOD (U.S. Department of Defense). 2010. Report on the compatibility of Department of Defense activities with oil and gas resource development on the Outer Continental Shelf (OCS), February 2010.

USDOD. 2013. Arctic Strategy.

USFWS (U.S. Fish and Wildlife Service). 1998. Roseate tern (*Sterna dougallii*) Northeastern Population Recovery Plan, First Update. Hadley, MA.

USFWS. 1999a. Kemp's Ridley Sea Turtle (*Lepidochelys kempii*). In South Florida Multi-Species Recovery Plan.

USFWS. 1999b. Cape Sable Seaside Sparrow: Multi-Species Recovery Plan for South Florida.

USFWS. 2001. Florida Manatee Recovery Plan, (*Trichechus manatus latirostris*), third revision. Atlanta, GA.

USFWS. 2002. Steller's Eider Recovery Plan. Fairbanks, AK.

USFWS. 2007. West Indian Manatee (*Trichechus manatus*) 5-Year Review: Summary and Evaluation. Jacksonville, Florida and Boquerón, Puerto Rico.

USFWS. 2008. Nothern Sea Otter (*Enydra lutris kenyoni*): Southwest Alaska Stock. Available online at: https://www.fws.gov/alaska/fisheries/mmm/stock/finalsouthwestalaskaseaottersar01aug2008.pdf. Accessed October 12, 2016.

USFWS. 2009a. Pacific Walrus: Questions and Answers. Available online at: https://www.fws.gov/alaska/fisheries/mmm/walrus/pdf/walrus_q_a.pdf. Accessed October 12, 2016.

USFWS. 2009b. Mississippi Sandhill Crane National Wildlife Refuge. Fact Page. National Wildlife Refuge System.

USFWS. 2009c. Piping Plover (*Charadrius melodus*) 5-Year Review: Summary and Evaluation. Northeast Region, Hadley, MA and Midwest Region, East Lansing, MI.

USFWS. 2010a. Polar Bear (*Ursus maritimus*): Chukchi/Bering Seas Stock. Available online at: https://www.fws.gov/alaska/fisheries/mmm/stock/final_cbs_polar_bear_sar.pdf. Accessed October 12, 2016.

USFWS. 2010b. Southwest Alaska Distinct Population Segment of the Northern Sea Otter (*Enhydra lutris kenyoni*) Draft Recovery Plan. Region 7, AK.

USFWS. 2010c. Arctic National Wildlife Refuge Bird List. Alaska Region. Available online at: http://www.fws.gov/refuge/arctic/birdlist.html. Accessed May 7, 2015.

USFWS. 2011a. Species Profile; Additional Species Information: Piping plover (*Charadrius melodus*).

USFWS. 2011b. Species Profile: Piping plover (*Charadrius melodus*). Available online at: http://ecos.fws.gov/speciesProfile/profile/speciesProfile.action?spcode=B079. Last updated December 16, 2013. Accessed February 3, 2015.

USFWS. 2011c. Species profile: Additional Species Information: Roseate tern (*Sterna dougallii dougallii*).

USFWS. 2011d. Species Profile: Roseate tern (*Sterna dougallii dougallii*). Available online at: http://ecos.fws.gov/speciesProfile/profile/speciesProfile.action?spcode=B07O. Last updated December 16, 2013. Accessed February 3, 2015.

USFWS. 2012. Subsistence Harvested Walrus Tagging Statistics by Location and Year. Available online at: http://www.fws.gov/alaska/fisheries/mmm/mtrp/pdf/factsheets/stats_walrus.pdf. Accessed October 12, 2016.

USFWS. 2013a. Rufa Red Knot Ecology and Abundance; Supplement to: Endangered and Threatened Wildlife and Plants; Proposed Threatened Status for the Rufa Red Knot (*Calidris canutus rufa*).

USFWS. 2013b. Gulf Restoration: The Importance of the Gulf of Mexico and its Watersheds to Migratory and Beach-nesting Birds. Available online at: http://www.fws.gov/gulfrestoration/gulfbirds.html. Accessed May 13, 2015.

USFWS. 2014a. Pacific Walrus Stock Assessment. Available online at: http://www.fws.gov/alaska/fisheries/mmm/stock/Revised_April_2014_Pacific_Walrus_SAR.pdf. Accessed October 12, 2016.

USFWS. 2014b. Northern Sea Otter (*Enhydra lutris kenyoni*): Southcentral Alaska Stock. April, 2014.

USFWS. 2014c. Short-tailed Albatross (*Pheobastria albatrus*). Five-year Review: Summary and Evaluation. Anchorage Fish and Wildlife Field Office.

USFWS. 2014d. Mississippi Sandhill Crane: Habitats. Available online at: http://www.fws.gov/refuge/Mississippi_Sandhill_Crane/wildlife_and_habitat/habitats.html. Accessed May 12, 2015.

USFWS. 2014e. Species Status and Fact Sheet: Whooping Crane. North Florida Ecological Services Office. Available online at: http://www.fws.gov/northflorida/whoopingcrane/whoopingcrane-fact-2001.htm. Accessed May 13, 2015.

USFWS. 2014f. National Wildlife Refuge System. Available online at: http://www.fws.gov/refuges/maps/NWRS_National_Map.pdf. Last updated December 23, 2013. Accessed February 4, 2015.

USFWS. 2015a. Pacific Walrus: The Endangered Species Act and Alaska Native Hunting. Available online at: http://www.fws.gov/alaska/fisheries/mmm/walrus/pdf/factsheet_esa.pdf. Accessed October 12, 2016.

USFWS. 2015b. Walrus. Available online at: http://www.fws.gov/alaska/fisheries/mmm/walrus/wmain.htm. Accessed December 15, 2015.

USFWS. 2015c. Polar Bear (*Ursus maritimus*) Conservation Management Plan, Draft. U.S. Fish and Wildlife, Region 7, Anchorage, AK.

USFWS. 2015d. Loggerhead Sea Turtle (*Caretta caretta*). Available online at: http://www.fws.gov/northflorida/SeaTurtles/Turtle%20Factsheets/loggerhead-sea-turtle.htm. Accessed December 15, 2015.

USFWS. 2015e. ECOS: Species Profile for Wood stork (*Mycteria americana*). Available online at: http://ecos.fws.gov/speciesProfile/profile/speciesProfile.action?spcode=B06O. Accessed May 13, 2015.

USFWS and U.S. Census Bureau. 2013. 2011 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation. FHW/11-NAT (RV).

USFWS and GSMFC (U.S. Fish and Wildlife Service and Gulf States Marine Fisheries Commission). 1995. Gulf Sturgeon (*Acipenser oryrinchus desotoi*) Recovery Management Plan.

USFWS and NMFS. 2009. Gulf Sturgeon (*Acipenser oxyrinchus desotoi*) 5-Year Review: Summary and Evaluation.

USGS (U.S. Geological Survey). 2012. Technical Announcement: Polar Bears in Alaska Observed with Patchy Hair Loss and Other Skin Lesions. Available online at: https://archive.usgs.gov/archive/sites/www.usgs.gov/newsroom/article.asp-ID=3162.html. Accessed December 15, 2015.

USGS. 2014. Energy Resources Program: Southern Alaska. Available online at: http://energy.usgs.gov/OilGas/AssessmentsData/NationalOilGasAssessment/USBasinSummaries.aspx?provcode=5003. Page Last Modified: Friday, November 06, 2015. Accessed November 15, 2015.

U.S. Department of the Navy. 2002. Draft Environmental Impact Statement for the Introduction of F/A-18 E/F (Super Hornet) Aircraft, Naval Facilities Engineering Command, Atlantic Division, Norfolk, Va., pp. 3-1, 3-2, 9-1, and 9-2.

U.S. Department of the Navy. 2004. Environmental Assessment/Overseas Environmental Assessment for East Coast Testing of the Tomahawk Land Attack Missile, Naval Facilities Engineering Command, Atlantic Division, Norfolk, VA.

USDOT (U.S. Department of Transportation). 2013a. Maritime Administration, Vessel Calls Snapshot, 2011.

USDOT. 2013b. Maritime Administration, The Economic Importance of the U.S. Shipbuilding and Repairing Industry, May 2013.

USEIA (U.S. Energy Information Administration). 2012. Natural Gas Annual Respondent Query System. Available online at: http://www.eia.gov/cfapps/ngqs/ngqs.cfm?f_report=RP7. Accessed October 12, 2016.

USEIA. 2014. Number and Capacity of Petroleum Refineries. Available online at: http://www.eia.gov/dnav/pet/pet_pnp_cap1_dcu_nus_a.htm. Accessed October 12, 2016.

USEPA (U.S. Environmental Protection Agency), Gulf of Mexico Program. 2004. Seagrass Habitat in the Northern Gulf of Mexico: Degradation and Restoration of a Valuable Resource. USEPA, U.S. Department of the Interior, U.S. Geological Survey Technical Report 855-R-04-001.

USEPA, Office of Water. n.d. National List of Beaches: 2010. Available online at: https://www.epa.gov/beach-tech/national-list-beaches. Accessed October 12, 2016.

USEPA. 2013. Map of Ecoregions, Level III. Available online at: ftp://ftp.epa.gov/wed/ecoregions/cec_na/NA_LEVEL_III.pdf. Accessed October 12, 2016.

USEPA. 2014. Climate Change Adaptation Plan. June 2014. Publication Number: EPA 100-K-14-001.

USEPA. 2015. National Ambient Air Quality Standards. Available online at: https://www.epa.gov/criteria-air-pollutants/naaqs-table. Last updated July 5, 2016. Accessed August 11, 2016.

U.S. Fleet Forces Command. 2010. Gulf of Mexico Range Complex Final Environmental Impact Statement/Overseas Environmental Impact Statement (EIS/OEIS), Volume 1, Page ES-1.

U.S. Fleet Forces Command. 2015. Fleet Training and Testing, Gulf of Mexico Range Complex. Available online at: http://aftteis.com/Background/Navy-Training-and-Testing/Training-Ranges. Accessed October 12, 2016.

University of Alaska. 2015. Checklist of Alaska Birds, 21st Edition. University of Alaska Museum Bird Collection. Fairbanks, AK: University of Alaska Fairbanks.

Valentine, D.L., G.B. Fisher, S.C. Bagby, R.K. Nelson, C.M. Reddy, S.P. Sylva, and M.A. Wood. 2014. Fallout Plume of Submerged Oil from Deepwater Horizon. Proceedings of the National Academy of Sciences 111(45):15906–15911.

Valentine, D.L., J.D. Kessler, M.C. Redmond, S.D. Mendes, M.B. Heintz, C. Farwell, L. Hu, F.S. Kinnaman, S. Yvon-Lewis, M. Du, E.W. Chan, F. Garcia Tigreros, and C. J. Villanueva. 2010. Propane Respiration Jump-Starts Microbial Response to a Deep Oil Spill. Science 330:208-211.

Vianna, J.A., R.K. Bonde, S.A. Caballero, J.B. Giraldo, R.P. Lima, A. Clark, M. Marmontel, B. Morales-Vela, M.J. DeSouza, L. Parr, M.A. Rodríguez-Lopez, A.A. Mugnucci-Giannoni, J.A. Powell, and F.R. Santos. 2006. Phylogeography, Phylogeny, and Hybridization in Trichechid Sirenians: Implications for Manatee Conservation. Molecular Ecology 15:433-447.

Viereck, L.A., C.T. Dyrness, A.R. Batten, and K.J. Wenzlick. 1992. The Alaska Vegetation Classification, General Technical Report PNW-GTR-286, USDOA, Pacific Northwest Research Station.

Vittor and Associates, Inc. 2003. Mobile Bay Submerged Aquatic Vegetation. Final Report to Mobile Bay National Estuary Program.

Wade, P.R., A. Kennedy, R. LeDuc, J. Barlow, J. Carretta, K. Shelden, W. Perryman, R. Pitman, K. Robertson, B. Rone, J.C. Salinas, A. Zerbini, R.L. Brownell, and P.J. Clapham. 2011. The World's Smallest Whale Population? Biol Lett 7:83–85.

Waite, J.M., M.E. Dahlheim, R.C. Hobbs, S.A. Mizroch, O. von Ziegesar-Matkin, J.M. Straley, L.M. Herman, and J. Jacobsen. 1999. Evidence of a Feeding Aggregation of Humpback Whales (*Megaptera novaeangliae*) around Kodiak Island, Alaska. Mar. Mammal Sci. 15:210-220.

Wallace, R.K. 1996. Coastal Wetlands in Alabama, Circular ANR-831, MASGP-96-018, Auburn University, Marine Extension and Research Center, Mobile, AL.

Waring, G.T., E. Josephson, K. Maze-Foley, and P.E. Rosel. 2010. U.S. Atlantic and Gulf of Mexico Marine Mammal Stock Assessments -- 2010. NOAA Technical Memorandum NMFS-NE-219.

Waring, G.T., E. Josephson, K. Maze-Foley, P.E. Rosel (Eds). 2013. U.S. Atlantic and Gulf of Mexico Marine Mammal Stock Assessments -- 2012. NOAA Technical Memorandum NMFS NE 223.

Waring, G.T., E. Josephson, K. Maze-Foley, and P.E. Rosel(Eds). 2016. U.S. Atlantic and Gulf of Mexico Marine Mammal Stock Assessments – 2015. NOAA Technical Memorandum NMFS NE 238.

Waters, M.R., S.L. Forman, T.A. Jennings, L.C. Nordt, S.G. Driese, J.M. Feinberg, J.L. Keene, J. Halligan, A. Lindquist, J. Pierson, C.T. Hallmark, M.B. Collins, and J.E Wiederhold. 2011. The Buttermilk Creek Complex and the Origins of Clovis at the Debra L. Friedkin Site, TX. Sci. 331:1599-1603.

Watkins, W.A. and W.E. Schevill. 1977. Sperm Whale Codas. J. Acoust. Soc. Am. 62:1486-1490.

Western Hemisphere Shorebird Reserve Network. 2009. Kachemak Bay. Available online at: http://www.whsrn.org/site-profile/kachemak-bay. Accessed May 7, 2015.

White, W.A., T.R. Calnan, R.A. Morton, R.S. Kimble, T.G. Littleton, J.H. McGowen, H.S. Nance, and K. E. Schmedes (Eds). 1986. Submerged Lands of Texas.

Whitehead, H. 2003. Sperm Whales: Social Evolution in the Ocean. University of Chicago Press, Chicago, IL.

Whitehead, H. and L. Weilgart. 1991. Patterns of Visually Observable Behaviour and Vocalizations in Groups of Female Sperm Whales. Behaviour 118:275-296.

Whitehead, H., R. Antunes, S. Gero, S.N.P. Wong, D. Engelhaupt and L. Rendell. 2012. Multilevel Societies of Female Sperm Whales (*Physeter Macrocephalus*) In The Atlantic And Pacific: Why Are They So Different? Int J Primatol 33 (5):1142-1164.

Whitten, K.R. 1990. Movement Patterns of the Porcupine Caribou Herd in Relation to Oil Development. Federal Aid in Wildlife Restoration Progress Report, Project W- 232 Study 3.34. Juneau, AK: ADF&G, Div. of Wildlife Conservation.

Whitten, K.R. and R.D. Cameron. 1980. Nutrient Dynamics of Caribou Forage on Alaska's Arctic Slope. In E. Reimers, E. Gaare, and G. Skjensberg (Eds.), *Proceedings of the Second International Reindeer/Caribou Symposium, Roros, Norway*. (pp. 159-166).

Wilkinson T., E. Wiken, J. Bezaury-Creel, T. Hourigan, T. Agardy, H. Herrmann, L. Janishevski, C. Madden, L. Morgan, and M. Padilla. 2009. Marine Ecoregions of North America. Commission for Environmental Cooperation. Montreal, Canada.

Williams, S.J., S. Penland, and A.H. Sallenger, Jr. 1992. Louisiana Barrier Island Study: Atlas of Shoreline Changes in Louisiana from 1853 to 1989. U.S. Department of the Interior, Geological Survey, Miscellaneous Investigations Series I-2150-A.

Withers, K. 2002. Shorebird Use of Coastal Wetland and Barrier Island Habitat in the Gulf of Mexico. Scientific World Journal 2:514-536.

Wooley, C.M. and E.J. Crateau. 1985. Movement, microhabitat, exploitation, and management of Gulf of Mexico sturgeon, Apalachicola River, Florida. North American Journal of Fisheries Management 5.4:590-605.

Wormuth, J.H., P.H. Ressler, R.B. Cady, and E.J. Harris. 2000. Zooplankton and Micronekton in Cyclones and Anti-Cyclones in the Northeast Gulf of Mexico. Gulf Mex. Sci. 18:23-34.

Würsig, B., T.A. Jefferson, and D. Schmidly. 2000. The Marine Mammals of Mexico. College Station, TX: Texas A&M University Press.

Yarbro, L.A. and P.R. Carlson. 2011. Seagrass Integrated Mapping and Monitoring for the State of Florida Volume 1. Mapping and Monitoring Report.

Zeller, D., S. Booth, E. Pakhomov, W. Swartz, and D. Pauly. 2011. Arctic Fisheries Catches in Russia, USA, and Canada: Baselines for Neglected Ecosystems. Polar Biology 34(7):955-973.

Zhang, K. and S. Leatherman. 2011. Barrier Island Population along the U.S. Atlantic and Gulf Coasts. Journal of Coastal Research 27(2):356-363.

Zimmerman, S.T. and M.J. Rehberg. 2008. Steller Sea Lion. Alaska Department of Fish and Game. Available online at: https://www.adfg.alaska.gov/static/education/wns/steller_sea_lion.pdf. Accessed October 12, 2016.

Zimmerman, S.T. and S.A. Karpovich. 2008. Wildlife Notebook Series: Humpback Whale. Alaska Department of Fish and Game. Juneau, AK. Available online at: https://www.adfg.alaska.gov/static/education/wns/humpback_whale.pdf. Accessed October 12, 2016.

This page intentionally left blank

Appendix D

Acoustic Environment and Marine Sound

This page intentionally left blank

Acoustic Environment and Marine Sound

Introduction

Once considered silent, the seas are now known to be alive with sounds. Some ocean sounds are the result of natural sources such as storms, earthquakes, waves, and marine animals that produce and use sound to communicate and discern their environment. Other sounds come from anthropogenic sources (those produced during human activities), such as vessels used by commercial fishers; transport of goods and services; or for exploration, construction, and production of traditional (e.g., oil and gas) and renewable (e.g., wind and tidal power) energy sources; during exercises for military preparedness and national defense; dredging of offshore sand for beach and barrier island improvements (e.g., hurricane protection); seismic research for earthquake detection; and even recreational boating (e.g., nature tours, fishing trips, weekend boaters) (Richardson et al., 1995; Nowacek et al., 2007; Southall et al., 2007; Weilgart, 2007).

Because human presence in the offshore environment has grown, so have anthropogenic sound levels. Current science shows that some sounds could adversely impact marine life in certain situations while having no perceived effect in other settings. Some sounds can interrupt important biological behaviors (e.g., courtship, nursing, feeding, and migration) and mask communication between animals. In more extreme instances, exposures to high levels or extended periods of sound can impose physiological effects, including hearing loss and mortality. Research shows that the same level of sound could have different levels of impact on marine life depending on where in the ocean the sound occurs. In addition, individuals of the same species can react to sound differently in different situations.

Balancing human activities with protection of marine life can be challenging, especially for issues like marine sound that are characterized as highly technical and subject to scientific uncertainty about risks, and that garner significant attention from a wide variety of stakeholders. This section seeks to provide basic information on the physics of marine sound, types of sound sources expected under the Proposed Action, what is known and unknown about effects of these sounds on marine life, and how BOEM approaches decisionmaking about marine sound issues.

Much of the following discussion of acoustic terminology, concepts, and application is based on Urick (1983), Richardson et al. (1995), and Au and Hastings (2008).

Fundamentals of the Physics of Marine Sound (Acoustics)

Human activities addressed in this document can produce airborne and underwater acoustic signals, or noise, but only those that eventually enter the water are addressed. This includes noise that could be produced in air, but is transmitted into water by structures or vessels that are both in air and water, and by direct transmission into water through the air/water interface.

When discussing acoustics, often the terms sound, signal, and noise are used interchangeably. Technically, this is incorrect and the choice of terms could be confusing. Also, whether a particular sound is a noise or a signal is a matter of perspective. For example, the sound a dolphin produces is the sound signal he is interested in, and could help him locate his next meal. To the human sonar operator, however, that dolphin sound is unwanted noise that has to be ignored while looking for echoes from sonar signals. For this discussion, the term “sound” will be used to represent both signals and noises universally. The exception will be in instances where specific terminology (e.g., ambient noise) is associated with a particular quantity commonly used by acousticians.

Terminology and Basic Concepts

Sound is generally understood to be energy in the environment perceived by the sense of hearing. It consists of waves of energy that propagate or pass through the environment in the form of particle motions and vibrations. These waves transit through solids as well as gas and liquid fluids, but sound waves do not have the same appearance as physical waves, like one might see when a pebble is dropped into pond. Rather, these waves consist of compression (squeezing together) and rarefaction (spreading apart) of the ocean's particles.

There are several parameters that are routinely used to characterize marine sounds, including the following:

- **<u>Pressure Level</u>** – Pressure level is a measure of the pressure existing in the ocean over the duration of the sound. Pressure is measured in micropascals (µPa), a unit of pressure in the International System of Units (SI). Additionally, because the range of perceptible pressures can vary over many orders of magnitude (i.e., many multiples of 10), a logarithmic scale (base 10) is normally used and reported in "dB" with a reference standard. In this way, the sound pressure level (SPL) is defined by $SPL = 20 \log_{10} (P/P_0)$, where P is pressure in the ocean and P_0 is the reference pressure. SPL is annotated as a numerical value followed by "dB re 1 µPa."

- **<u>Frequency or Sound Spectra</u>** – Because sound is the time-varying level of pressure, the rate at which it varies over time is the frequency of the sound. The frequency content of a sound can be a constant or pure tone (often called a continuous wave [CW]), a varying set of discrete frequency over time, or contain multiple frequencies simultaneously. The standard unit for frequency is hertz (Hz), or cycles per second.

- **<u>Duration</u>** – The length of the sound from start to finish is typically represented in time units like seconds or milliseconds (s or ms). Note this can be used to describe the actual signal produced by the source, or the signal at a point in the ocean after it has been smeared or spread during propagation.

- **<u>Rise Time</u>** – The length of time from the start of the signal to its highest pressure. The unit is typically ms or microseconds (µs).

- **<u>Repetition Rate or Pulse Interval</u>** – Repetition rate is the frequency of the transmission in units of the number of repetitions per unit time (e.g., three repetitions per minute), while pulse interval (the reciprocal of the repetition rate) is in time units. For the previous example, pulse interval is 20 seconds or 1/3rd of a minute.

There are other variations or clarifying parameters with sound characteristics, including the following:

- **<u>Sound Exposure Level (SEL)</u>** – An SEL is a measure of acoustic energy in a sound. Effectively, it is the integration of the energy associated with the pressure over the duration of the sound. Like SPLs, SELs have a wide range of values, so they also use a logarithmic scale, but the reference value is a standard energy unit. They are written as a numerical value followed by the unit "dB re 1 μPa^2-s."

- **<u>Source Level Values</u>** – Source levels can be measured at many ranges. For powerful sources such as airguns, this can be accomplished most easily hundreds of meters from the source, to avoid receivers from overshooting maximum levels they are calibrated to receive. Later, they are scaled back to a source with a 1-m (3-ft) radius. For clarity and to prevent errors, when this scaling is performed, it is a common practice to add "at 1 m" to the sources description. Thus, the unit for a source level is typically "dB re 1 µPa at 1 m."

- **Peak, Zero-to-Peak, Peak-to-Peak, and RMS Qualifiers** – Historically, different acousticians have used different measuring equipment and terminology for their specific tasks. For example, acousticians evaluating explosive or airgun data typically measured positive and negative pressures, and reported them as "peak-to-peak" pressures, while acousticians in other communities used "zero-to-peak" or "root-mean-squared (rms)" terminology. For clarity, the type of SPL used will be designated using these qualifiers.

Description of Sources Associated with the Proposed Action

Several sound-producing activities would occur under the Proposed Action that could impact marine life. These potential impacts are shown as broad categories in **Figure D-1**. Examples of the sources and their descriptions are in **Section 3.5** in the Programmatic EIS.

Vessel activity and seismic surveys likely would be the most prevalent sound-producing activities associated with the Proposed Action. Vessel noise is a combination of narrow-band (tonal) sounds, usually in frequency bands < 500 Hz, and some broadband sound. Primary sources of vessel noise are propeller cavitation, propeller singing, and propulsion; other sources include auxiliaries, flow noise from water dragging along the hull, and bubbles breaking in the vessel's wake (Richardson et al., 1995). Large vessels produce sounds; vessels that use dynamic positioning (DP) for station keeping employ thrusters to maintain position and produce higher sound levels. Representative source levels for DP vessels range from 184 to 190 dB re 1 µPa at 1 m, with a primary amplitude frequency < 600 Hz (Blackwell and Greene, 2003; Kyhn et al., 2011; McKenna et al., 2012). Ice breakers are a sound source in the Arctic. They can escort vessels or manage ice near drill rigs during some months. Active ice breaking in moderate to heavy ice is among the loudest industry activities in the Arctic. As an example, when compared with open-water transit, the noise signature by the U.S. Coast Guard (USCG) icebreaker *Healy* increased approximately 10 dB between 20 Hz and 2 kilohertz (kHz) when breaking ice. Highest noise levels resulted while the ship was engaged in backing-and-ramming maneuvers, owing to cavitation when operating the propellers astern or in opposing directions. In frequency bands centered near 10, 50, and 100 Hz, source levels reached 190 to 200 dB re 1 µPa at 1 m (full octave band) during icebreaking operations (Roth et al., 2013).

Airguns are used for deep-penetration seafloor surveys during oil and gas exploration. An airgun is a stainless steel cylinder filled with high-pressure air. An acoustic signal is generated when air is released nearly instantaneously into the surrounding water. During seismic surveys, seismic pulses are emitted at intervals of 5 to 30 seconds, and occasionally at shorter or longer intervals. Although airguns have a frequency range from approximately 10 to 2,000 Hz, most acoustic energy is radiated at frequencies < 500 Hz. Amplitude of the acoustic impulse emitted from the source is equal in all directions, but airgun arrays do possess some directionality due to different phase delays between airguns in different positions within an array. Broadband rms source levels for airgun arrays typically range between 190 and 270 dB re 1 µPa at 1 m (DECC, 2011).

In addition to these sources, there are multiple emerging technologies that could come to fruition during the course of activities considered under the Proposed Action, including (1) new airgun designs that better control the frequency content of the signal, reducing much of the unwanted higher frequencies that occur in the current signals (Norton, 2015); and (2) development of new marine vibrators, currently underway. Additionally, sound attenuation technologies such as the AdBm Corporation (2014) noise abatement technology, currently being tested, might be usefully incorporated into various sources.

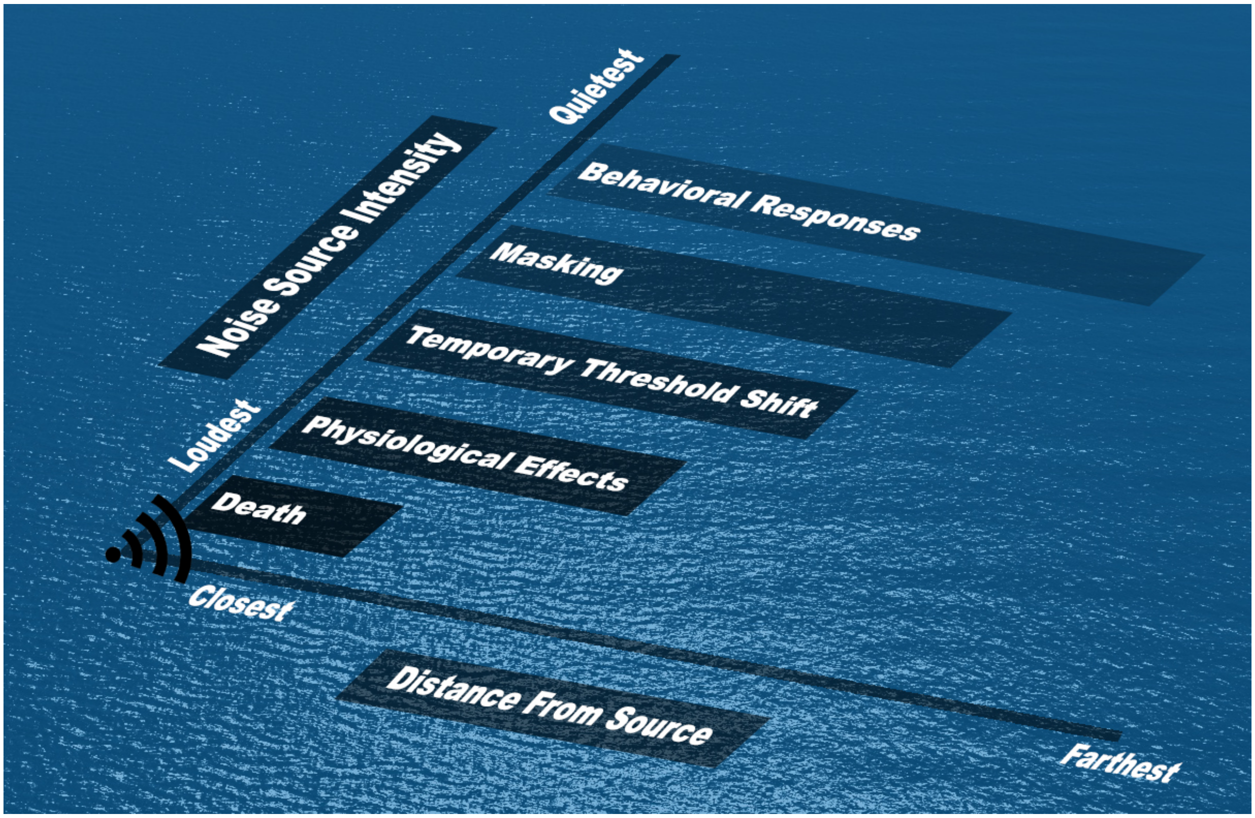


Figure D-1. Relationship among Sound Levels and Potential Effects on Animals

Characterization of Acoustic Sources

Acoustic sources can be described by their sound characteristics. For the regulatory process, they are generally divided into two categories: (1) impulsive (e.g., lightning strikes, explosives, airguns, and impact pile drivers), and (2) non-impulsive (e.g., sonars, vibratory pile drivers) (NMFS 2015). Currently, there is no universally accepted definition for what constitutes an impulsive sound, but they are generally understood to be powerful sounds with relatively short durations, broadband frequency content, and rapid rise times to peak levels. In general, these sound characteristics have been observed to be more physiologically damaging to marine mammals than non-impulse sounds with equivalent pressures and energies (Southall et al. 2007), and therefore are examined with a different and more protective set of acoustic threshold criteria.

Configuration of an acoustic source also directly affects how that source transfers energy into the marine environment. Impulsive and non-impulsive sound sources also can be characterized as controlled or non-controlled. Sound produced by controlled anthropogenic sources (e.g., hydrophones, airguns, speakers) take their basic sound-producing characteristics from these individual components, but beam patterns (e.g., large-scale 3D patterns of projected acoustic energy) are restrained by configuration of the source array itself. The equivalent in the visual environment is that a lightbulb defines the color and brightness of the light produced, but reflectors and lenses in a flashlight determine how the light is broadcast outward. Under a controlled source, adjustments to timing and amplitudes of the signal produced by each individual source element can refine and steer the beam pattern within the constraint dictated by the array configuration. Another type of source, called non-controlled (e.g., radiation pattern of sound from a driven pile as the shock wave travels down its length), also can exhibit some beam-forming and steering, but most unintended sound sources (e.g., cavitation and vessel thrusters) radiate in an approximately omnidirectional fashion.

One final consideration, especially for controlled anthropogenic sources, is the difference between point and distributed sources. Some sources that are physically smaller (e.g., completely contained within a sphere with a 1-m [3-ft] diameter) can be considered point sources. However, most other sources (e.g., an airgun array, which could be tens of meters in width and length) are distributed sources. For a distributed source, a receiver must be some distance away from the source to perceive it acoustically as a single, or point, source. Closer to the source, a receiver gathers many signals from all separate components of the source. The receiver then is considered in the “near-field.” Once a receiver is beyond this range, and can interpret the signal as a point source, it is considered in the source’s “far-field.” This problem is visually analogous to viewing an illuminated 100-story building at night and attempting to characterize the lighting intensity around it. One would need to be miles away from that building to see it as a single light source. Anywhere closer, and individual floors could be seen, and how they are perceived would strongly influence the level of light received. If the observer was only 10 m (32.8 ft) from the ground floor, higher floors would be partially seen and the overall light being produced by such a structure could be greatly underestimated.

This distinction between near-field and far-field is a particularly important one for distributed sources such as airgun arrays. This is because the most severe potential impacts on animals generally occur near the source and an understanding and assessment of these impacts requires a correct understanding of the sound field in the near-field. If a receiver (i.e., animal) is in the near-field of an airgun array, it will receive energy from all individual sources (e.g., individual airguns) in that array (just as the observer of the building would receive some light from the many floors in the above example). But the closest individual source (i.e., floor for the building example) will tend to be the dominant source, with other individual sources in the array making smaller contributions to the overall received sound level. Because these additional contributions will be delayed in time (due to the physical geometry and the time differences required for sound travel from individual sources to the receiver), and might not be in phase (i.e., peak pressures might not arrive simultaneously or “in-phase”), these contributions will seldom sum to the maximum energy of the overall signal, and could actually result in diminishing some of the signal. In this way, near-field sound of the real array would always be less than that modeled for a theoretical point source. In effect, estimating the near-field sound field around an assumed point source is conservative because it will always be greater than the actual values in the near-field.

Propagation

Once a sound source is characterized (i.e., sound levels at very close proximity to the source are understood), the next step is to consider how acoustic energy emitted from the source propagates (or spreads). How sound from a particular source propagates is a function of the characteristics of the source, and properties of the medium through which it travels (in this case, water). There are four basic physical processes that affect sound propagation:

- **Spreading** – The average energy on the surface of an acoustic wavefront decreases as the wavefront expands over time. Essentially, as the range from the source increases, the same amount of energy spreads out over an ever-increasing surface area. When the wavefront looks like an expanding sphere, the spreading is assumed to be “spherical” and transmission loss (TL) decreases as predicted by the equation: $TL = 20 \log_{10} (r)$, where r is the radius of the modeled sphere. Spherical spread occurs to approximately 1,000 m (3,280 ft) from a sound source in deep water and to a radius approximately equal to the depth of the water in shallow water. Once an expanding sphere reaches and begins to interact with the ocean surface and bottom boundaries, the expanding wavefront more closely resembles a cylinder. At that time, spreading is classified as “cylindrical,” and TL follows the relationship: $TL – 10 \log_{10} (r)$, where r is now the radius of the cylinder.

- **Absorption** – Loss of acoustic energy to heat energy as sound propagates through the ocean. Rate of this energy loss is related directly to the distance sound has traveled, and its frequency. Absorption increases with distance and frequency.

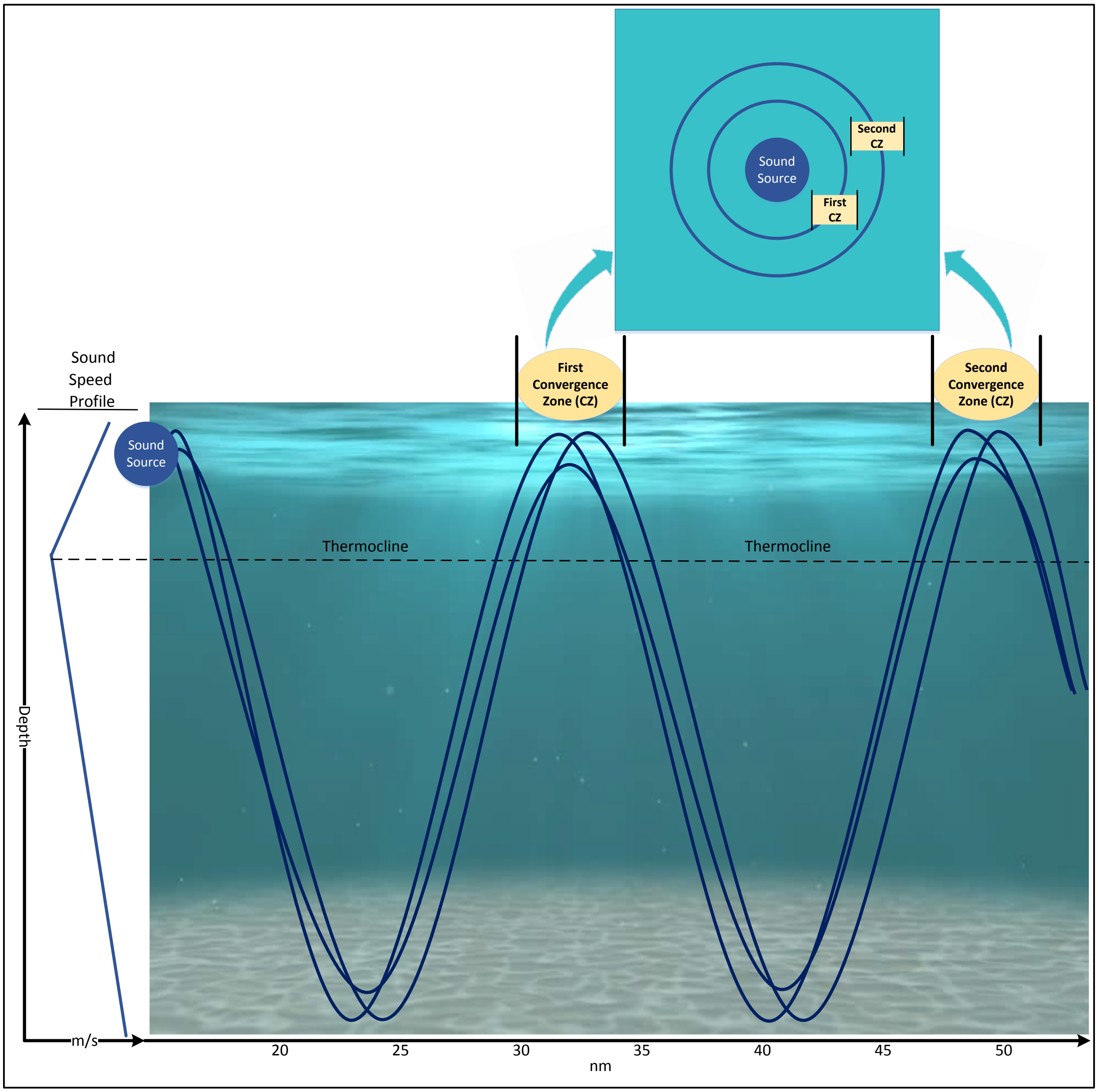
- **Refraction** – Bending of a sound wave as it changes speed in the ocean. Sound speed changes in water as a function of variations in temperature, salinity, and hydrostatic pressure. Sound velocity also can change horizontally in the ocean due to the presence of different water masses, currents, and eddies. For example, the Gulf Stream is usually much warmer than waters it is passing through, and sound speed in the Gulf Stream varies accordingly. Sound will bend towards areas promoting lower sound speeds.

- **Reflection** – Sound is deflected off the interface between two media having differing sound speed properties. This happens at the air/sea and water/sediment interfaces of the ocean. It also can occur when discrete objects (like air bubbles or fish air bladders) occur in the water column or the biota inhabiting the water column.

Given these variables, predicting the exact propagation of sound in the oceans is nearly impossible, without detailed knowledge of the acoustic environment parameters (i.e., all local conditions that influence acoustic propagation and ambient noise conditions). However, the acoustic community has worked for many decades to understand and quantify these parameters. Today, many important parameters required to predict propagation have been identified and mapped well enough to support representative propagation modeling in most U.S. waters. However, care should always be exercised in propagation modeling given the possibility of unusual conditions (e.g., significant weather events, river runoff, variable currents, eddy conditions), and the expected variability of certain parameters (e.g., variability in individual sound velocity profiles [SVP] and multiple SVPs in the propagation area, bathymetry, bottom roughness, wave heights). The following describe the most common propagation modes in U.S. waters, and their distributions:

- **Shallow Water Propagation** – There are two definitions of shallow water commonly used. The first is bathymetrically shallow water, which is used to refer to water < 200 m (656 ft) deep (i.e., the continental shelf). The second is “acoustically” shallow water where sound propagation is characterized by numerous surface and bottom interactions. Although these two definitions do not generally and perfectly coincide, most of the U.S. continental shelf is acoustically shallow water. Most of the shelf regions, therefore, exhibit TL approximations that are somewhere between spherical and cylindrical spread, with a nominal TL value governed by the equation: $TL = 17 \log_{10}$ (range). Note that even though many Arctic areas are shallower than 200 m (656 ft), sound propagation for the region is discussed separately later.

- **Convergence Zone Propagation** – Convergence Zone (CZ) propagation exists in deeper water. This occurs where some part of a wavefront is initially refracted downward as it propagates outward from the source and then, refracted back towards the (due to the higher sound speeds deep in the water column) before it can interact with the seafloor. The distance from the sound source where this portion of the sound returns to the surface in narrow range bands is 56 to 65 km (30 to 35 nautical miles [nmi]) away from the sound source (**Figure D-2**). Near the surface, the ring around the source where the CZ occurs is called the CZ annulus (**Figure D-2**) and the TL to these areas can be 20 to 30 dB less than that outside the annulus. Also, the captured wavefront can continue to produce additional annuli at multiples of the range of the first CZ (i.e., if the first CZ is at 60 km [32 nmi], the second will occur at approximately 120 km [65 nmi], the third at 180 km [97 nmi], and so on). **Figure D-2** presents a representative CZ transmission where the sound source is near the surface. As the signal propagates to the right from the source, the sound wave concentrate as if they have been focused, producing a CZ which occurs typically 56 to 65 km (30 – 35 nmi) from the sound source and the width of each CZ at the surface is 5 to 10% of the range. At the surface, between the sound source and the first CZ and between CZs is a zone of silence, where the acoustic waves are diffracted downward.



Source: Adapted from Burdic 1984

Key: nm = nautical miles; kft = thousands of feet; dB = decibels.

Figure D-2. Convergence Zone

- **Bottom Interactive Propagation** – In most areas where water is not deep enough to support CZ propagation or the source is not in a duct or a deep sound channel (explained below), most of the sound eventually interacts with the seafloor. A combination of the seafloor's slope, depth, and composition as well as the characteristics of the source (e.g., beam patterns, frequencies) determine how and how much of the sound energy is scattered, reflected, or penetrates into the seafloor. Generally, seafloor interactions, especially repeated interactions, are significant contributors to the attenuation of propagated sound. There is no easy or general rule of thumb to predict these interactions because each depends on the specific conditions present.

- **Surface or Near-Surface Duct Propagation** – In the near-surface or "mixed layer," wind and wave action serve as the mechanism that drives the heating or cooling of the water by the atmosphere. Seasonal cooling can drive near-surface sound speed to be less than that directly below it. This process can create a condition known as a surface duct in which sound can be trapped by reflections off the ocean's surface and refracted upward before sound can leave the duct. Strength of the duct is strongly frequency dependent (i.e., depending on depth and strength of the duct, only frequencies above a critical value will be trapped), and that sound exhibits cylindrical spreading loss.

- **Deep Sound Channel** – Deep sound channels exist where minimum sound speed in the water column occurs deep enough that much of the sound transmitted from a source near that depth will refract before it can interact with the ocean's surface or bottom. The minimum sound speed can vary from approximately 1,300 m (4,265 ft) deep in the mid-latitudes to near the surface in the Arctic. Minimum sound speed depth serves as the channel's axis; that is, it is the depth toward which the wavefronts are constantly refracting. Sound trapped in this way can propagate long distances within a channel, governed by cylindrical spreading and the absorption losses for its frequency. Deep sound channels exist in most intermediate and deep waters.

- **Arctic Propagation** – Arctic sound propagation acts like that of a surface duct, except that in Arctic, propagation in the duct typically goes all the way to the seafloor. In this condition, sound is constantly trying to refract upward where it reflects off the surface. An additional complication in the Arctic is the potential presence of sea ice. Complexity of the ice and water interface and how to model it acoustically remains a challenge.

In GOM waters, propagation modes will progress from shallow to bottom interactive to CZ (if there is sufficient water depth to support CZ propagation) as a source progresses from shore to sea (i.e., shallow to very deep water). Some care must be exercised in predicting propagation because the extent of the sound field around a source could transit across several different propagation modes or various azimuthal directions could have different propagations modes from the "pure" and isolated modes described previously. Also, as a source transits farther north, the deep sound channel rises in the water column and affects the CZ propagation mode in deep waters. Sound in Arctic waters propagates as described earlier.

Ambient Noise

Common usage of the term "ambient noise" is generally understood to consist of any noise, natural or anthropogenic, that might be heard in the ocean. This is the widest definition of the term, and difficult to use effectively in acoustic analyses. This differs from the traditional technical definition of the term, which includes all of the sound that a hydrophone receiver (an electromechanical source that observes sound underwater) would observe minus any internal electrical or mounting "self noise" (i.e., noise produced by the presence of the hydrophone, like cable strumming, which did not exist in the ocean itself when the hydrophone was absent), and minus all anthropogenic noises, except for the ubiquitous distant shipping noise. Discrete anthropogenic sources typically are excluded from this traditional definition because of their strong local influence and variability, which are difficult to characterize or use in receiver system performance analyses. When they are known and can be adequately characterized, they are normally included in a second or refined iteration of these analyses.

This bifurcation is evident in **Figure D-3**, where the more traditional definition and sources are captured in standard Wenz curves (portion (c)), while discrete anthropogenic sources are presented in portion (b). For ease of comparison, portion (a) presents marine mammal hearing frequency bands, as defined in NMFS (2015). Some care is needed when comparing these three portions of the figure because each represents a different parameter (e.g., hearing range/sensitivity, source level at 1 m [3 ft], spectral noise level), but this arrangement allows a rapid comparison of where these characteristics occur as a function of their frequencies.

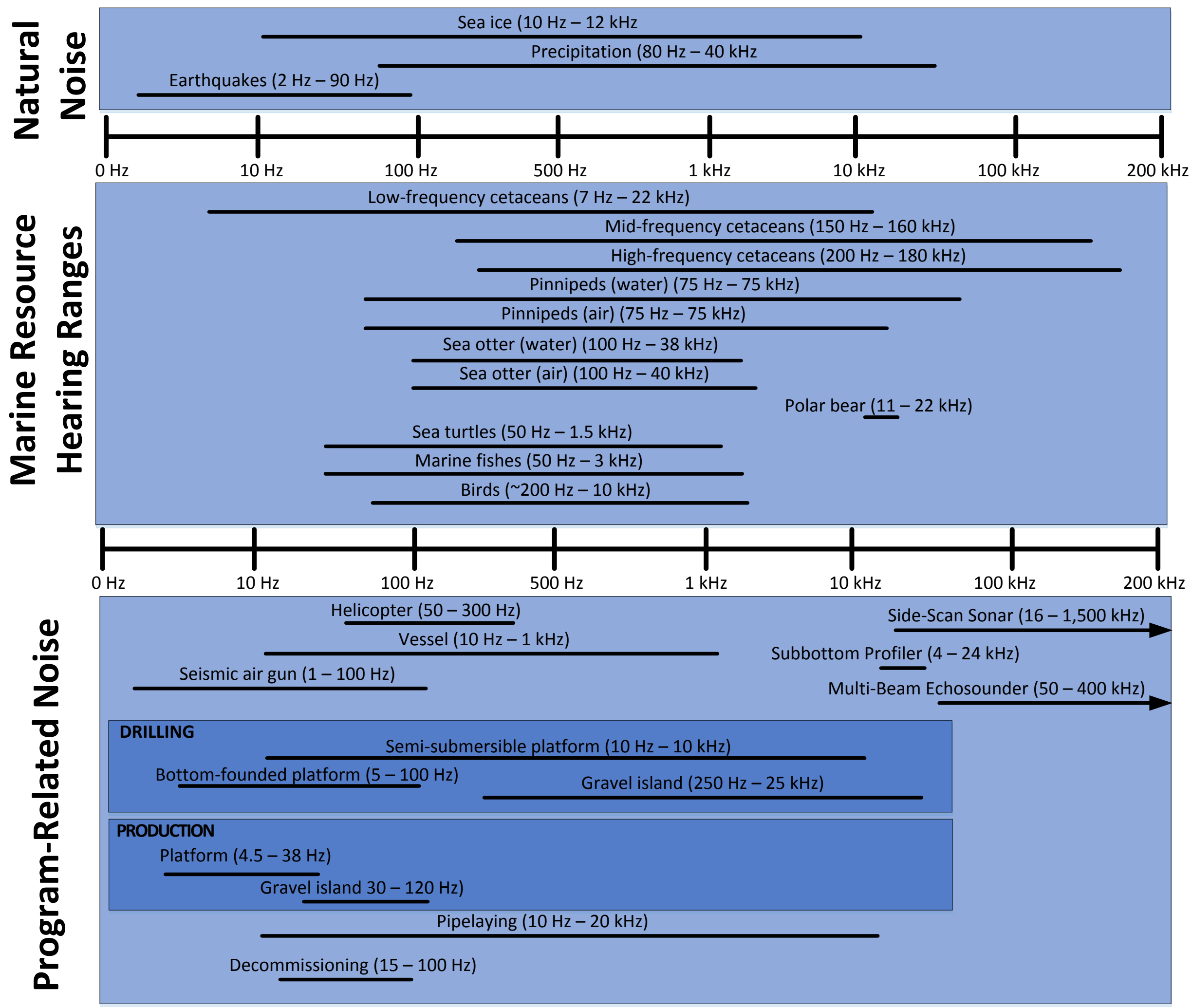


Figure D-3. Ambient Noise, Anthropogenic Source, and Marine Mammal Hearing Spectra

Reverberation

Reverberation is another standard acoustic analysis term with a precise meaning and definition that is not always used accurately in the policy realm. Standard technical usage of the term revolves around the scattering of sound from an acoustic source from numerous scatterers throughout the water column and at the ocean's surface and bottom. The combined return from these scatterers is called reverberation. It is most often used for monostatic sources (e.g., the source system's transmitters and receivers are collocated or nearly so), and reverberation can interfere with echoes received by the system. The level of reverberation is directly related to the source level (i.e., if the source level is increased by a set level, the reverberation also rises by that level), much like automobile headlights in a fog, and the reverberation decreases as a function of time. This differs from some policy uses of the term, where it could be used to describe persistence of a source's signal, through multipaths, that cause some persistence of a signal to remain in the effected sound field after the main pulse has passed. Both cases are caused by similar physical processes, but how they are applied in analyses is different. This document does not use the term beyond its standard acoustic analysis meaning.

Marine Animals as Receivers

When acting as acoustic receivers, marine animals exhibit many of the same characteristics of sound sources, including: (1) a range of perceived acoustic levels (i.e., how loud or quiet they are); (2) a frequency spectrum sensitivity; (3) beam patterns of an animal's sensors; and (4) signal durations an animal can detect (including how the animal processes the signal). These acoustic sensor characteristics, along with cues and clues created by the sounds propagating in the environment and ambient noise conditions, determine how successful and useful the animal's hearing will be.

Thus far, this section has discussed sounds that would be "heard" by a receiver, just as sound is heard by the human ear. However, there is another mechanism for sensing sound (or particle vibration) other than detecting the associated pressure. It involves using sensors that respond directly to motion of the water particles themselves. Humans exhibit this same capacity, demonstrated when we "feel" rather than hear a sound if the sound is strong enough, like when we are near a speaker. Sensing through the motion of water particles is one of the principle methodologies used by fish to perceive their environment. Because particle velocity is directly related to acoustic pressure, and this pressure rapidly decreases as sound propagates away from the source, particle motion also rapidly decreases with distance from a source. Currently, impacts from particle motion (if any) are being studied.

Challenges and Issues in Modeling

There are numerous issues that affect the ability to accurately model and predict potential impacts of marine sound on marine life: (1) variability and uncertainty in most parameters (inputs) used in the modeling process; (2) broad temporal and spatial areas that need to be examined; (3) development of new thresholds and analytical techniques; (4) continuous updating of databases used for modeling (including acoustic parameters like sediment conditions or weather and marine mammal densities); and (5) the need to address new technology and system developments or field techniques that may be employed by system operators in the field. The general approach to addressing these challenges is use of constantly improving, more sophisticated modeling techniques, along with utilization of conservative assumptions throughout the modeling process where uncertainty exists. Current state-of-the-art approaches include (1) sensitivity analyses; (2) complex area acoustic characterizations; (3) statistical and numerical analytical techniques; and (4) ongoing scientific studies and investigations to improve understanding of the base science (e.g., source characteristics, parameter databases, animal hearing) and complex interactions (e.g., animal behavioral studies, population based effects). Although modeling approaches have progressed, much more is needed to improve their accuracy, especially as it relates to predicting effects on marine life.

Potential Biological Impacts

Many species of marine animals produce and use sound to communicate as well as to orient, locate, and capture prey, and to detect and avoid predators (Payne and Webb 1971, Richardson et al. 1995, Hastings et al. 1996, Hastings and Popper 2005, Southall et al. 2007). When anthropogenic noise occurs within animals' hearing ranges and is at a high enough intensity, research has shown that exposures can range from producing no perceived impact or can lead to adverse physical and psychological effects. Possible adverse effects include (1) mortality; (2) permanent or temporary hearing loss and physiological stress responses; (3) masking of important sound signals; (4) behavioral responses such as fright, avoidance, and changes in physical or vocal behavior; and (5) indirectly altering prey availability (Nowacek et al., 2007; Southall et al., 2007; Clark et al., 2009; Casper et al., 2012a,b). There is no set pattern to when one or another potential impact would occur. Furthermore, responses of marine animals to acoustic stimuli vary widely, depending on the species, the individual, hearing ability, context of animal activities at the time of ensonification (e.g., feeding, spawning, migrating, calving), properties of the stimuli, and prior exposure of the animals (Nowacek et al., 2007; Southall et al., 2007; Normandeau Associates, 2012).

Although uncertainty still remains, considerably more information is known about marine mammal hearing and potential susceptibility to impacts from noise. Good sources of information on marine mammal hearing can be found in Southall et al. (2007) and Appendix H of BOEM (2014). In general, mysticetes (baleen whales) such as the blue whale could be more susceptible to sounds generated from the Proposed Action given overlap in the frequency of these noises with mysticete hearing (Southall et al., 2007; Di Iorio and Clark, 2010; Risch et al., 2012). Less is known about sea turtle and fish hearing or impacts on individual fish and catch rates (Popper et al., 2007; Halvorsen et al., 2011, 2012; Normandeau Associates, 2012; BOEM 2014). Very little is known about whether and how invertebrate species can hear and if other aspects of sound, such as particle motion, could be of concern (Pye and Watson, 2004; Lovell et al., 2005, 2006; Mooney et al., 2010, 2012; Normandeau Associates, 2012; BOEM, 2014).

It is generally believed that the greatest potential for impact of sound on marine life is through behavioral changes and auditory masking. Of the sound sources under the Proposed Action, seismic surveys, decommissioning using explosives, drilling, and associated vessels are believed to have the greater potential for effects. Behavioral responses to acoustic stimuli have been observed in some instances in relation to these sound sources, but not always. Auditory masking is considered the obscuring of sounds of interest (e.g., whale communications) by other, stronger sounds, often at similar frequencies. Masking is not solely dependent on distance from source but also on cumulative sources as well as population density and distribution (Clark et al., 2009; Hatch et al., 2012). In reviewing available scientific information, the extent for the potential of masking and, if it occurs, the degree of effect, remains unclear. It is also unclear whether masking is an issue for fish, sea turtles, and invertebrates (Normandeau Associates, 2012; BOEM, 2014).

The larger question, as it relates to impacts on behavior and masking, is if and when these effects reach biologically significant levels. Determining where the potential exists for biological significance has been the focus of numerous studies, some funded by BOEM, but is still largely unknown.

Proposed and Historic Mitigation Techniques

Appendix I contains a discussion of mitigation measures in place to protect against impacts of noise from the Proposed Action, particularly seismic surveys using airguns and decommissioning operations using explosives. Although these measures are not assumed to be 100 percent effective, they are expected to substantially reduce the risk of hearing loss or injury to marine mammals. They are considered less effective for protecting against masking or behavioral disruption given that mitigation efforts are focused on smaller spatial scales when compared to the larger spatial scope where these effects could occur. Limitations to the effectiveness of mitigation measures are due to a variety of factors, including physical conditions; presence of animals at the surface; difficulty in species identification; vocalization of animals; lack of knowledge regarding sound produced by some species; and regular masking by vessel noise of lower frequency vocalizations, such as those produced by mysticetes. Although these mitigations are largely aimed at reducing effects on marine mammals, they incidentally afford some level of protection to other species (e.g., sea turtles, fish, invertebrates) in the same areas as marine mammals when mitigation efforts are applied.

Summary and Discussion of Applying Knowledge of Acoustics to the Decision

Overall, there is potential for impacts on marine animals from noise associated with certain activities under the Proposed Action, primarily in the form of masking and behavioral disruption. Given scientific uncertainty surrounding potential effects from sound sources under the Proposed Action, and whether they could rise to the level of biological significance, it is assumed that impacts can range from negligible to major in nature. Responses of marine animals in any given situation vary widely, depending on the species, the individual, hearing ability, context of their activities at the time of ensonification, properties of the stimuli, and prior exposure of the animals.

Fully predicting impacts from marine sound and the degree of any effect is impossible at the programmatic scale being considered under the Proposed Action. As discussed in **Section 1.4** in the Programmatic EIS, in conducting this analysis, the Programmatic EIS examines existing scientific evidence relevant to evaluating reasonably foreseeable significant adverse impacts of oil and gas E&D activities on the human environment. BOEM has identified impacts from sound (including impacts from particle motion) as an area of incomplete or unavailable information. Subject matter experts that prepared the Programmatic EIS diligently searched for pertinent information, and BOEM’s evaluation of such impacts is based on research methods and theory generally accepted in the scientific community. BOEM’s subject matter experts acquired and used previously developed and newly available scientifically credible information and, where gaps remained, exercised their best professional judgment to extrapolate baseline conditions and impact analyses using accepted methodologies based on credible information. For purposes of this Programmatic EIS, all impacts reasonably foreseeable at later stages of the oil and gas development process have been considered, and the characterization of impact magnitude and duration is supported by scientific evidence. BOEM’s assessment of impacts is not based on conjecture, media reports, or public perception; it is based on research methods, theory, and modeling applications generally accepted by the scientific community.

BOEM utilizes the best available scientifically credible information in its tiered decision-making process and any new data on the impacts of noise would be incorporated as they are made available. At the programmatic stage, incomplete and unavailable information does not affect the ability of the decision-maker to make an informed choice. Subsequent approvals of more site- or region-specific analyses that could result from implementation of the Proposed Action would consider the most recent science available at the time of the decision as well as additional mitigation measures (and their efficacy) to limit the potential for masking or behavioral disruption (e.g., time-area closures, limiting activities in space and time). It is also crucial to continue efforts to lessen the scientific gap between what is known and unknown about marine animal hearing, and potential effects from sounds associated with this Proposed Action. BOEM has played a key role in improving this scientific understanding (see http://www.boem.gov/Fact-Sheet-on-Sound-Studies/) and remains steadfastly committed to funding and supporting science needed to better understand anthropogenic sounds and their impacts on marine life. BOEM also is dedicated to using adaptive management for this complicated issue so that approaches evolve as understanding expands and the science matures.

References

AdBm Corporation. 2014. AdBm Demonstration at Butendiek Offshore Wind Farm with Ballast Nedam. Available online at http://adbmtech.com/wp/wp-content/uploads/2014/10/AdBm-Butendiek-Demo-Approved-for-Release.pdf. Accessed October 13,2016.

Au and Hastings. 2008. Principles of Marine Bioacoustics. First edition, Springer Science+Business Media, NY, NY, 2008.

Blackwell, S.B. and C.R. Greene, Jr. 2003. Acoustic measurements in Cook Inlet, Alaska, during August 2001. Greeneridge Rep. 271-2, Rep. from Greeneridge Sciences Inc., Santa Barbara, CA, for National Marine Fisheries Service, Anchorage, AK, 43 pp.

BOEM (Bureau of Ocean Energy Management). 2014. Atlantic OCS Proposed Geological and Geophysical Activites: Mid-Atlantic and South Atlantic Planning Areas, Final Programmatic Environmental Impact Statement. BOEM 2014-001.

Burdic, W.S. 1984. Underwater Acoustic System Analysis. Englewood Cliffs, New Jersey, U.S.A.: Prentice-Hall, 1984. Pp. 150.

Casper, B.M., M.B. Halvosen, A.N. Popper. 2012a. Are Sharks Even Bothered by a Noisy Environment? In: The Effects of Noise on Aquatic Life. Advances in Experimental Medicine and Biology: 730. Doi 10.1007/978/-1-4419-7311-5_20.

Casper, B.M., A.N. Popper, F. Matthews, T.J. Carlson, M.B. Halvorsen. 2012b. Recovery of Barotrauma Injuries in Chinook Salmon, *Oncorhynchus tshawytscha* from Exposure to Pile Driving Sound. PLoS ONE 7(6): e39593. doi:10.1371/journal.pone.0039593.

Clark, C.W., W.T. Ellison, B.L. Southall, L. Hatch, S.M. Van Parijs, A. Frankel, D. Ponirakis. 2009. Acoustic Masking in Marine Ecosystems: Intuitions, Analysis, and Implication. Marine Ecology Progress Series. Vol 395: 201-222, 2009.

DECC (Department of Energy and Climate Change, United Kingdom). 2011. Review and Assessment of Underwater Sound Produced from Oil and Gas Sound Activities and Potential Reporting Requirements under the Marine Strategy Framework Directive. July 2011. Available online at https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/50017/finreport-sound.pdf. Accessed October 12, 2016.

Di Iorio L., Clark C. W. 2010. Exposure to seismic survey alters blue whale acoustic communication. Biol. Lett. (6) 51-54. doi:10.1098/rsbl.2009.0651.

Halvorsen, M.B., T.J. Carlson, A.N. Popper, B.M. Casper, C.M. Woodley. 2011. Hydroacoustics Impacts on Fish from Pile Installation. National Cooperative Highway Research Program, Research Results Digest 363. October 2011.

Halvorsen, M.B., D.G. Zeddies, W.T. Ellison, D.R. Chicoine, A.N. Popper. 2012. Effects of mid-frequency Active Sonar on Hearing in Fish. Journal of the Acoustical Society of America: 131 (1). January 2012.

Hastings, M.C. and A.N. Popper. 2005. Effects of Sound on Fish. Study for the California Department of Transporation Contact No. 43A0139, Task Order 1. January 28, 2005.

Hastings, M.C., Popper, A.N., Finneran, J.J., and Lanford, P.J. 1996. Effect of low frequency underwater sound on hair cells of the inner ear and lateral line of the teleost fish *Astronotus ocellatus*. J. Acoust. Soc. Am. 99:1759-1766

Hatch, L.T., C.W. Clark, S. M. Van Parijs, A.S. Frankel, D.W. Ponirakis. 2012. Quantifying Loss of Acoustic Communication Space for Right Whales in and around a U.S. National Marine Sanctuary. Conservation Biology Volume 26, Issue 6. December 2012. Pages 983–994

Kyhn et al. (Kyhn, L.A., Tougaard, J. & Sveegaard, S.). 2011. Underwater noise from the drillship Stena Forth in Disko West, Baffin Bay, Greenland. National Environmental Research Institute, Aarhus University, Denmark. 30 pp. – NERI Technical Report No. 838. Available online at http://www.dmu.dk/ Pub/FR838.pdf.

Lovell et al. (Lovell, J.M., Findlay, M.M., Moate, R.M. and Yan, H.Y.). 2005. The hearing abilities of the prawn Palaemon serratus. Comparative Biochemistry and Physiology Part A: Molecular & Integrative Physiology, 140(1), pp.89-100.

Lovell et al. (Lovell, J.M., R.M. Moate, L. Christiansen, and M.M. Findlay). 2006. The relationship between body size and evoked potentials from the statocysts of the prawn Palaemon serratus. The Journal of Experimental Biology 209:2480-2485.

McKenna et al. (McKenna, M.F., D. Ross, S.M. Wiggins, and J.A. Hildebrand). 2012. Underwater radiated noise from modern commercial ships. Journal of the Acoustical Society of America 131:92-103.

Mooney et al. (Mooney, T.A., Hanlon, R.T., Christensen-Dalsgaard, J., Madsen, P.T., Ketten, D.R., Nachtigall, P.E.). 2010. Sound detection by the longfin squid (Loligo pealeii) studied with auditory evoked potentials: sensitivity to low-frequency particle motion and not pressure. Journal of Experimental Biology, 213(21), pp.3748-3759.

Mooney et al. (Mooney, T.A., R. Hanlon, P.T. Madsen, J. Christensen-Dalsgaard, D.R. Ketten, and P.T. Nachtigall). 2012. Potential for sound sensitivity in cephalopods. Pages 125-128 in Popper, A.N. and A. Hawkins, eds, The Effects of Noise on Aquatic Life. Springer: New York, NY. 695 pp.

NMFS. 2016. “Technical Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing – Underwater Acoustic Threshold for Onset of Permanent and Temporary Threshold Shifts,” NOAA Technical Memorandum NMFS-OPR-55, July 2016.

Normandeau Associates. 2012. Effects of noise on fish, fisheries, and invertebrates in the U.S. Atlantic and Arctic from energy industry sound-generating activities. Workshop Report U.S. Department of the Interior, Bureau of Ocean Energy Management. Contract No. M11PC00031. 361 pp. Available online at https://www.cbd.int/doc/meetings/mar/mcbem-2014-01/other/mcbem-2014-01-submission-boem-04-en.pdf. Accessed January 5, 2016.

Norton, J. 2015. eSource: The Tuneable Impulsive Seismic Source – A Technical Leaflet. February 2015.

Nowacek, D.P., L.H. Thorne, D.W. Johnston, P.L. Tyack. 2007. Responses of Cetaceans to Anthropogenic Noise. Mammal Review, Vol. 37, No. 2 81-115.

Payne, R. and D. Webb. 1971. Orientation by Means of Long Range Acoustic Signaling in Baleen Whales. Annals of the New York Academy of Sciences. Vol. 188, pp. 110-141.

Pye, H.J. and W.H. Watson III. 2004. Sound detection and production in the American lobster, Homarus americanus: Sensitivity range and behavioral implications. Journal of the Acoustical Society of America 115:2486.

Richardson, W.J., C.R. Greene Jr., C.I. Malme, and D.H. Thomson. 1995. Marine Mammals and Noise, Academic Press, San Diego, Calif.Risch et al., 2012

Roth, E.H., V. Schmidt, J.A. Hildebrand, S.M. Wiggins. 2013. Underwater Radiated Noise Levels of a Research Icebreaker in the Central Arctic Ocean. Journal of the Acoustic Society of America: 133 (4). April 2013.

Urick, R. J. 1983. Principles of Underwater Sound. 3rd edition. McGraw-Hill, New York, NY.

Southall, B.L., A.E. Bowles, W.T. Ellison, J.J. Finnergan, R.L. Gentry, C.R. Greene, Jr., D. Kastak, D.R. Ketten, J.H. Miller, P.E. Nachtigall, W.J. Richardson, J.A. Thomas, P.L. Tyack. 2007. Marine Mammal Noise Exposure Criteria: Initial Scientific Recommendations. Aquatic Mammals, Vol. 33, No. 4. 2007.

Weilgart, L.S. 2007. The Impacts of Anthropogenic Ocean Noise on Cetaceans and Implications for Management. Canadian Journal of Zoology (85) 1091-1116. 2007.

This page intentionally left blank

Appendix E

Negligible to Minor Impact Determinations

This page intentionally left blank

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." The scoping process, including early public involvement and opportunity to comment on the Proposed Action, aids in identifying these significant environmental issues. 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 the 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 reviews conducted by subject matter experts.

Through the analysis of direct and indirect effects on each resource area, BOEM determined whether the potential impacts of the Proposed Action would 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 tables in this appendix, and 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)	No Impact	No impacts on air quality are expected from noise.
Traffic		
Aircraft Traffic	No Impact	Aircraft/vessel traffic is not expected to affect air quality.
Ship/Vessel Traffic		
Routine Discharges		
Sanitary Wastes	No Impact	Routine discharges are not expected to affect air quality.
Gray Water, Misc. Discharges		
Drilling Mud/Cuttings/Debris		
Bottom/Land Disturbance		
Drilling	No Impact	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	Moderate	Refer to **Section 4.4.1.1** of the Programmatic EIS.
Offshore		
Lighting/Physical Presence		
Onshore Facilities	No Impact	Lighting from onshore/offshore facilities is not expected to affect air quality.
Offshore Facilities		
Visible Infrastructure		
Onshore	No Impact	Onshore/offshore infrastructure is not expected to affect air quality.
Offshore		
Space Use Conflicts		
Onshore Facilities	No Impact	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 4.4.5** of the Programmatic EIS.
CDE	Moderate	

Key: CDE = Catastrophic Discharge Event

Water Quality

Impact-Producing Factor	Impact Determination for the Proposed Action	Explanation
Noise		
Noise (seismic, ship, aircraft, drilling, trenching, production, construction, platform removal)	No Impact	No impacts on 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 that 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. Refer to **Section 4.4.1.2** of the Programmatic EIS.
Bottom/Land Disturbance		
Drilling	Minor	Drilling would be localized and impacts such as bottom disturbance and discharge of drill cuttings are not expected to occur outside of the immediate area where drilling would occur.
Infrastructure Emplacement (other than noise)	Negligible – Minor	Bottom disturbance associated with infrastructure emplacement would be 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 would be temporary and localized. Water quality would return to normal once completed due to settling and mixing.
Air Emissions		
Onshore	No Impact	Onshore/offshore air emissions are not expected to affect water quality.
Offshore		
Lighting/Physical Presence		
Onshore Facilities	No Impact	Onshore/offshore lighting from facilities is not expected to affect water quality.
Offshore Facilities		
Visible Infrastructure		
Onshore	No Impact	Onshore/offshore infrastructure is not expected to affect water quality.
Offshore		
Space Use Conflicts		

Impact-Producing Factor	Impact Determination for the Proposed Action	Explanation
Onshore Facilities	No Impact	Space-use conflicts from onshore/offshore facilities are not expected to affect water quality.
Offshore Facilities		
Non-Routine Events		
Accidental Spills	Minor – Major	Refer to **Section 4.4.5** of the Programmatic EIS.
CDE	Moderate – Major	

Key: CDE = Catastrophic Discharge Event; 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 – Minor	The impacts on 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, but recent research provides new insight on the potential for some potential impacts on marine invertebrates (Popper et al. 2001, Wale et al 2013). In decapods, these impacts could include alteration of “attention” and other environmental communication factors.
Traffic		
Aircraft Traffic	No Impact	No traffic impacts on benthic resources are expected during normal operations.
Ship/Vessel Traffic		
Routine Discharges		
Sanitary Wastes	Negligible	Discharges of sanitary wastes, gray water, bilge, and other miscellaneous discharges are permitted. These discharges are not expected to persist in the water column after discharge and would not have an effect on benthic communities.
Gray Water, Misc. Discharges		
Drilling Mud/Cuttings/Debris	Negligible – Minor (overall) Moderate (immediate vicinity of drilling discharges)	Refer to **Section 4.4.1.3** of the Programmatic EIS for discussion of potential moderate impacts from drilling muds and cuttings. The majority of impacts from drilling muds and cuttings discharges would be limited to a few hundred meters from the discharge location, although studies have found drill cuttings can be detectable up to 1 km (0.6 mi) from the wellsite (CSA 2004, CSA 2006). Only soft bottom communities would be anticipated in close proximity to drilling in all areas. Impacts include burial, turbidity, and increased oxygen demand described in **Section 4.4.1.4**. Avoidance criteria for both shallow and deep water sensitive benthic communities are anticipated to have been implemented with mitigation measures providing protection to those benthic communities. Intentional disposal of debris from OCS platforms is now prohibited. Previous accumulation of debris has been shown to be minimal from older platforms in the GOM (Gallaway et al. 2008) and negative impacts on benthic communities would be expected to be minimal, and could also provide beneficial hard substrate.
Bottom/Land Disturbance		
Drilling	Negligible – Minor	Avoidance criteria for both shallow and deep water sensitive benthic communities are anticipated to have been implemented with mitigation measures. Impacts on soft bottom communities from the installation of structures and anchors in the GOM, Cook Inlet, Beaufort and Chukchi Seas (e.g., crushing, sediment resuspension) are unavoidable but considered minor.
Infrastructure Emplacement (other than noise)		
Pipeline Trenching		

Impact-Producing Factor	Impact Determination for the Proposed Action	Explanation
Onshore Construction (other than noise)	No Impact	Onshore construction would not affect benthic marine environments offshore.
Structure Removal (other than noise)	Negligible - Minor	Explosive severance methods used could result in damage or mortality to organisms within the vicinity of the blast or associated sediment plume, although long-term turbidity is not expected from platform removal operations. No sensitive benthic communities are anticipated in proximity to structures due to initial implementation of avoidance measures.
Air Emissions		
Onshore	No Impact	Onshore/offshore air emissions are not expected to directly affect benthic communities.
Offshore		
Lighting/Physical Presence		
Onshore Facilities	No Impact	Onshore/offshore lighting is not expected to affect benthic communities.
Offshore Facilities		
Visible Infrastructure		
Onshore	No Impact	"Visible" onshore/offshore infrastructure (not offshore infrastructure emplacement) is not expected to affect benthic communities.
Offshore		
Space Use Conflicts		
Onshore Facilities	No Impact	Space-use conflicts are not expected to affect benthic communities.
Offshore Facilities		
Non-Routine Events		
Accidental Spills	Negligible – Major	Refer to **Section 4.4.5** of the Programmatic EIS.
CDE	Moderate – Major	

Key: CDE = Catastrophic Discharge Event; GOM = Gulf of Mexico

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)	No Impact	This IPF is not expected to affect coastal and estuarine habitats.
Traffic		
Aircraft Traffic	No Impact	This IPF is not expected to affect coastal and estuarine habitats.
Ship/Vessel/Vehicle Traffic	Negligible – Minor (AK) Moderate (GOM)	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 GOM 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 deepwater rigs and platforms in the GOM (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 at its lower end 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, Louisiana and Corpus Christi/Port Aransas-area ports in Texas); however, upper portions of these channels and other channels are used by OCS support vessels and those channels could incur erosion. Vessel traffic in the Alaska program areas would be increased with the Proposed Action according to the scenario in **Chapter 3** of the Programmatic EIS, but potential impacts can be mitigated with CMPs and armoring heavily used channels. For the Alaska program areas, limited disturbance could also occur as a result of vessels traveling in the nearshore coastal habitat and vehicles traveling on unpaved roads during the summer could produce dust that settles on surrounding vegetation, reducing photosynthesis and productivity. Refer to **Section 4.4.1.4** of the Programmatic EIS.
Routine Discharges		
Sanitary Wastes	No Impact	This IPF is not expected to affect coastal and estuarine habitats.
Gray Water, Misc. Discharges		
Drilling Mud/Cuttings/Debris		

<table>
<tr><th>Impact-Producing Factor</th><th>Impact Determination for the Proposed Action</th><th>Explanation</th></tr>
<tr><td colspan="3">Bottom/Land Disturbance</td></tr>
<tr><td>Drilling</td><td>No Impact</td><td>This IPF is not expected to affect coastal and estuarine habitats.</td></tr>
<tr><td>Infrastructure Emplacement (other than noise)</td><td>No Impact</td><td>This IPF is not expected to affect coastal and estuarine habitats.</td></tr>
<tr><td>Pipeline Trenching</td><td rowspan="2">Minor
(Beaufort Sea, Cook Inlet, GOM)

Moderate
(Chukchi Sea)</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 Beaufort Sea, Cook Inlet, and GOM, production pipelines would generally tie-in to existing distribution pipelines that go to shore. For the Chukchi Sea, a distribution pipeline would need to be constructed to shore that could result in local and temporary impacts on nearshore habitat with bottom disturbance, turbidity, and sedimentation. There could also be permanent removal of shore and marsh fringe habitat. With proper landfall siting to avoid sensitive habitats and proper installation techniques (e.g. directional drilling), direct impacts on coastal and estuarine habitat should be minor for any pipelines coming to shore. Long-term, indirect impacts from erosion of the disturbed area could be avoided with proper installation and erosion control techniques. 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. Refer to Section 4.4.1.4 of the Programmatic EIS.</td></tr>
<tr><td>Onshore Construction (other than noise)</td><td>Onshore construction (other than noise) would probably not be needed in GOM or Cook Inlet, but in the Arctic, onshore support facilities, roads, and pipelines would be expected particularly for the Chukchi Sea Program Area. Construction and operation associated with onshore support facilities, roads, and pipelines would result in removal of thousands of acres of coastal habitat and increase vehicular traffic in the vicinity of the facilities could settle dust on nearby coastal habitat if the road is unpaved. Limited disturbance could occur as a result of vehicles traveling over the onshore habitat off of established roads. The Arctic coastal plain is approximately 25,000 square miles (O'Sullivan 1961) so the presence of additional facilities, roads, and vehicular traffic would not be expected to have a major effect on the expansive area of coastal and estuarine habitats adjacent to the Alaska program areas, particularly with care in siting, minimizing the footprint, and using proper construction techniques. USACE, BLM, and state CZM permitting programs would be expected to hold new onshore support facilities, roads, and pipelines to a minimum size and out of the most sensitive coastal habitats.</td></tr>
<tr><td>Structure Removal (other than noise)</td><td>No Impact</td><td>This IPF is not expected to affect coastal and estuarine habitats.</td></tr>
</table>

Impact-Producing Factor	Impact Determination for the Proposed Action	Explanation
Air Emissions		
Onshore	No Impact	This IPF is not expected to affect coastal and estuarine habitats.
Offshore		
Lighting/Physical Presence		
Onshore Facilities	No Impact	This IPF is not expected to affect coastal and estuarine habitats.
Offshore Facilities		
Visible Infrastructure		
Onshore	No Impact	This IPF is not expected to affect coastal and estuarine habitats.
Offshore		
Space Use Conflicts		
Onshore Facilities	No Impact	This IPF is not expected to affect coastal and estuarine habitats.
Offshore Facilities		
Non-Routine Events		
Accidental Spills	Minor – Major	Refer to **Section 4.4.5** of the Programmatic EIS.
CDE	Moderate – Major	

Key: BLM = Bureau of Land Management; CDE = Catastrophic Discharge Event; CMP = Conflict Management Plan; CZM = coastal zone management; E&D = exploration and development; GOM = Gulf of Mexico; IPF = impact-producing factor; LA = Louisiana; 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	Effects of noise on pelagic communities were deemed negligible to minor because under routine operations, some impulsive (high-intensity) noises could irreversibly damage internal anatomy and physiology of marine pelagic organisms that are not capable of avoiding the sounds (i.e., plankton, eggs and larvae). However, such impacts would occur only in close proximity to the sound source, and are therefore highly localized and would not impact marine pelagic organisms at the population level. Additionally, non-impulsive sounds such as vessel noise could mask biologically relevant sounds such as presence of mates, predators, or prey. Such effects could be reversible once noise returns to ambient levels, but could result in subtle tolerance or habituation of the noise with unknown long-term consequences (Radford et al. 2016, Nedelec et al. 2016, Holles et al. 2013)
Traffic		
Aircraft and Ship/Vessel Traffic	Negligible	Aircraft would have no effect on pelagic communities. Ships and other vessel traffic through the area are expected to have, at most, a negligible impact on pelagic communities.
Routine Discharges		
Routine Discharges (sanitary wastes, gray water, miscellaneous discharges)	Minor	Discharges would have a minor impact because 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		Elevated turbidity can reduce the amount of light available for photosynthesis by phytoplankton, impact feeding opportunities for visual foraging zooplankton (including larval fishes), and suspended material can clog and abrades appendages and feeding structures on individual zooplankters (Wilber and Clarke 2001, Kjelland et al. 2015). Impacts are expected to be minor because impacts from drilling muds/cuttings/debris are expected to be localized to the discharge area and minimal and because of temporary 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 – Minor	Bottom disturbance could introduce turbidity, which could interfere with photosynthesis in phytoplankton and feeding and respiration in zooplankton. However, because these impacts are expected to be temporary and localized they would not affect pelagic organisms at the population level.
Air Emissions		
Onshore	No Impact	This IPF is not expected to affect pelagic communities.
Offshore		
Lighting/Physical Presence		
Onshore Facilities	No Impact	This IPF is not expected to affect pelagic communities.
Offshore Facilities	Minor	Zooplankton, fish larvae, and some invertebrates are attracted to artificial lights directed to the water's surface at night (Keenan et al. 2007). Plankton attracted to lights could be eaten by fish and other species such as squids that are also attracted to the lights. Because platforms light only a small volume of water around the structure, population-level effects on phototactic organism are not expected.
Visible Infrastructure		
Onshore	No Impact	This IPF is not expected to affect pelagic communities.
Offshore		
Space Use Conflicts		
Onshore Facilities	No Impact	This IPF is not expected to affect pelagic communities.
Offshore Facilities		
Non-Routine Events		
Accidental Spills	Minor – Major	Refer to **Section 4.4.5** of the Programmatic EIS.
CDE	Moderate – Major	

Key: CDE = Catastrophic Discharge Event; IPF = impact-producing factor; 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	Negligible – Moderate	Refer to **Section 4.4.1.6** of the Programmatic EIS.
Ship Noise		
Aircraft Noise		
Drilling Noise		
Trenching Noise		
Production Noise		
Onshore Construction		
Offshore Construction		
Platform Removal (includes explosives use)		
Traffic		
Aircraft Traffic	Negligible – Minor (cetaceans) Minor – Moderate (pinnipeds, polar bears, and sea otters [AK])	Aircraft noise is not expected to have an impact on cetacean species due to the height that aircraft fly above the water and the fact that most cetaceans are submerged the majority of the time. 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.
Vehicle Traffic	Negligible to 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 would not have an effect on marine mammals.
Gray Water, Misc. Discharges		
Drilling Mud/Cuttings/Debris	Negligible – Minor (cetaceans, bears, otters) Negligible – 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 would be localized and impacts such as bottom disturbance and discharge of drill cuttings are not expected to occur outside of the immediate area where drilling would occur.
Infrastructure Emplacement (other than noise)		Bottom disturbance associated with infrastructure emplacement would be localized and temporary. It would not be expected to result in loss of habitat or other serious impact.
Pipeline Trenching	Negligible – Moderate	See above.
Onshore Construction (other than noise)		Onshore construction would not affect cetaceans. Pinnipeds, polar bears, and sea otters could be impacted at haul outs or onshore. These impacts are expected to be localized. See **Section 4.1.1.6** of the EIS.
Structure Removal (other than noise)		Structure removal (other than noise) would be temporary and localized. Impacts on marine mammals are not expected.

Impact-Producing Factor	Impact Determination for the Proposed Action	Explanation
Air Emissions		
Onshore	Negligible – Minor	Onshore/offshore air emissions are not expected to affect marine mammals.
Offshore		
Lighting/Physical Presence		
Onshore Facilities	Negligible – Minor	No impacts on marine mammals are expected from lighting. Impacts of the physical presence of infrastructure on pinnipeds or fissiped habitat could occur and would vary depending upon the size and location of the infrastructure. Some animals could be displaced from preferential denning or resting habitat. Some cetaceans might avoid structures.
Offshore Facilities		
Visible Infrastructure		
Onshore	No Impact	This IPF is not expected to affect marine mammals.
Offshore		
Space Use Conflicts		
Onshore Facilities	No Impact	This IPF is not expected to affect marine mammals.
Offshore Facilities		
Non-Routine Events		
Accidental Spills	Negligible – Major	Refer to **Section 4.4.5** of the Programmatic EIS.
CDE		

Key: AK = Alaska; CDE = Catastrophic Discharge Event; IPF = impact-producing factor

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 would be reflected and not penetrate into the water. For sound that would penetrate, the duration would be much shorter in water than air. Thus, the effects on sea turtles are limited to disturbance reactions, particularly to a limited number of individuals resting on the sea surface.
Drilling Noise		Drilling noise would be 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.
Pipeline Trenching Noise		Trenching noise would be short-term and localized in the open ocean environment and could result in limited behavioral disturbance. Individuals are not confined to the area and can move freely away from the area of auditory discomfort.
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.
Decommissioning (Platform Removal (includes explosives use))	Negligible – Moderate	The implementation of existing BSEE guidelines for explosive platform removal would minimize the potential for physical injuries in the GOM Program Area. However, considering the larger number of anticipated removals in the Gulf, there is a residual risk of disturbance and/or injury to undetected sea turtles within the blast. 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	Much of the aircraft noise would be reflected and would not penetrate into the water. For sound that does penetrate, the duration would be much shorter in water than air. Thus, the effects on sea turtles are limited to disturbance reactions, particularly to a limited number of individuals resting on the sea surface.
Ship/Vessel Traffic	Negligible – Moderate	Risk of ship strike would 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. A higher risk of strike throughout the GOM 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 Gray Water, Misc. Discharges Drilling Mud/Cuttings/Debris	Negligible – Minor	These permitted discharges would be localized, short-term in duration, and are not expected to have a measurable effect on sea turtles.
Bottom/Land Disturbance		
Drilling	Negligible – Minor	Drilling would be localized and impacts such as bottom disturbance and discharge of drill cuttings are not expected to occur outside of the immediate area where drilling would occur and is not expected to result in loss of habitat (Neff 2005).
Infrastructure Emplacement (other than noise)		Bottom disturbance associated with infrastructure emplacement would be localized and temporary. It is not expected to result in loss of habitat or other serious impact.
Pipeline Trenching		Bottom disturbance associated with trenching would be 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) would not occur on nesting beaches and would not affect nesting sea turtles or hatchlings.
Structure Removal (other than noise)		Structure removal (other than noise) would be temporary and localized and would not result in loss of habitat
Air Emissions		
Onshore Offshore	Negligible – Minor	Onshore/offshore air emissions are not expected to affect sea turtles since emissions would be localized and dissipate quickly
Lighting/Physical Presence		
Onshore Facilities	Negligible – Minor	Depending on the location of onshore facilities to nesting beaches, there is the potential for minor impacts on nesting sea turtles and hatchlings due to disorientation associated with facility lighting.

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 would be located too far offshore to disorient hatchlings.
Visible Infrastructure		
Onshore	No Impact	This IPF is not expected to affect sea turtles.
Offshore		
Space Use Conflicts		
Onshore Facilities	No Impact	This IPF is not expected to affect sea turtles.
Offshore Facilities		
Non-Routine Events		
Accidental Spills	Negligible – Major	Refer to **Section 4.4.5** of the Programmatic EIS.
CDE		

Key: BSEE = Bureau of Safety and Environmental Enforcement; CDE = Catastrophic Discharge Event; GOM = Gulf of Mexico; IPF = impact-producing factor

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. Investigations into the effects of underwater seismic survey airguns on diving seabirds are extremely limited; however, studies performed by Stemp (1985) and Lacroix et al. (2003) did not observe any mortality to the several species of seabirds studied when exposed to seismic survey noise; furthermore, they did not observe any differences in distribution or abundance of those same species as a result of seismic survey activity.
Ship Noise		Short-term and transient effects. Localized disturbance/possible temporary displacement of some species, others would be drawn to follow vessels. Birds have a relatively restricted hearing range for airborne noise, and hearing sensitivity seems most acute in the range of 1 to 5 kHz (Dooling and Popper 2007) and ship noise falls between 10 Hz to 1 kHz.
Aircraft Noise		Short-term and transient effects. Localized disturbance/possible temporary displacement, potential for disturbance of breeding birds at colonies, which could be mitigated completely by careful selection of flight routes. Studies of birds exposed to frequent, low-level military jet aircraft overflights and simulated mid- to high-altitude sonic booms (with mortars, shotguns, and propane cannons) have shown aircraft and detonation noise to elicit some short-term behavioral responses but to have little effect on reproductive success (Ellis et al. 1991). Birds of prey have been reported to habituate to low level helicopter flights and exhibit no effects on their reproductive success (Delaney et al. 1999, Andersen et al. 1989), and low-level (< 500 ft above ground level) military training flights have been shown to have no effects on the establishment, size, and reproductive success of wading bird colonies in Florida (Black et al. 1984). Additionally, birds have been shown to return to pre-disturbance behavior within 5 minutes of the disturbance (Komenda-Zehnder et al. 2003).
Drilling Noise		Short-term and transient effects. Localized disturbance/possible temporary displacement of some marine species. Most noise generated during drilling will primarily affect seabirds and waterfowl that dive below the water surface. Despite noise generated during drilling operations, seabirds are attracted to offshore structures (Tasker et al. 1986, Baird 1990, Russell 2005, and Montevecchi 2006).

Impact-Producing Factor	Impact Determination for the Proposed Action	Explanation
Trenching Noise		Short-term and transient effects. Localized disturbance/possible temporary displacement of some marine species. Most noise generated during offshore trenching would primarily affect seabirds and waterfowl that dive below the water surface. Impacts would be strongest along the line of the trenching activity. Impacts could be avoided or minimized onshore by locating pipeline corridors away from nesting aggregations and/or by scheduling trenching activities to avoid the nesting period.
Production Noise		Localized disturbance/possible temporary displacement of some species, other species, such as gulls, would be drawn to platforms and use them for resting or food aggregations (Tasker et al. 1986, Russell 2005). Additionally, noise from production activities (4.5 Hz to 120 Hz) falls well below the airborne hearing range of birds (a few hundred hertz to approximately 10 kHz) (Dooling and Popper 2007).
Offshore Construction		Localized disturbance/possible temporary displacement of some species from the immediate area of activity. Some species would avoid noise and activity, others would become acclimatized and return to the area for the duration of construction activity. Possibly some small loss of foraging habitat for benthic foragers. Although not directly related to construction; weapons testing noise has been reported to have no significant effect on bald eagle activity or reproductive success, suggesting habituation of the birds to the noise (Brown et al. 1999).
Onshore Construction		Localized disturbance/possible temporary displacement of some species from the immediate area of activity. Some species would avoid noise and activity, others would become acclimatized and return to the area for the duration of construction activity. The potential for major impacts on nesting and colonial birds can be mitigated by careful placement of onshore facilities. Although not directly related to construction; weapons testing noise has been reported to have no significant effect on bald eagle activity or reproductive success, suggesting habituation of the birds to the noise (Brown et al. 1999).
Platform Removal (includes explosives use)		Short-term and localized disturbance and temporary displacement of foraging and resting marine species. Based on military weapons testing, noise has been reported to have no significant effect on bald eagle activity or reproductive success, suggesting habituation of the birds to the noise (Brown et al. 1999), which could translate to explosives used during platform removal.

Impact-Producing Factor	Impact Determination for the Proposed Action	Explanation
Traffic		
Aircraft Traffic	Minor	Short-term and transient effects. Localized disturbance/possible temporary displacement, potential for disturbance of breeding birds at colonies, which would be mitigated completely by careful selection of flight routes. Studies by Black et al. (1984), Ellis et al. (1991), Andersen et al. (1989), and Delaney et al. (1999) have shown that various aircraft noise sources elicit short-term behavioral responses but have no significant effect on activity or reproductive success due to habituation of the birds to the noise.
Ship/Vessel Traffic	Minor	Short-term and transient effects. Localized disturbance/possible temporary displacement of some species, others would be drawn to follow vessels. Birds have a relatively restricted hearing range for airborne noise and hearing sensitivity seems most acute in the range of 1 to 5 kHz (Dooling and Popper 2007) and ship noise falls between 10 Hz to 1 kHz.
Routine Discharges		
Sanitary Wastes	Negligible	Discharges of sanitary wastes are regulated. Permitted discharges are not expected to persist in the water column after discharge.
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. According to Neff (2005), discharged drilling mud does not increase to high concentrations in the water column and affects only a small parcel of water and Neff et al. (2000) have shown that the majority of cuttings settle rapidly to the seafloor and would cover an 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 would be some temporary loss of benthic foraging habitat until re-colonization occurs, which could take several years.
Bottom/Land Disturbance		
Drilling	Minor	Drilling is localized and occurs in a relatively small area. Drilling operations are temporary and would likely be phased over many years. Cuttings and debris would 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 (see Routine Discharges). Depending upon the habitat type at the drill site, there could be some temporary loss of a small area of benthic foraging habitat until re-colonization occurs, which could take several years.

Impact-Producing Factor	Impact Determination for the Proposed Action	Explanation
Infrastructure Emplacement (other than noise)		Temporary disturbance that could trigger avoidance or attraction behaviors by some birds (Tasker et al. 1986, Baird 1990, Russell 2005, and Montevecchi 2006). Platform operation could continue for several decades for production platforms. Each platform covers a relatively small area. Mitigation would be achieved through consultation with Federal agencies concerning compliance with the ESA and the MBTA.
Pipeline Trenching		Short-term and transient effects. Localized disturbance/possible temporary displacement of some marine species, and some potential loss of benthic habitat. Impacts would be strongest along the line of the trenching activity. Impacts could be avoided or minimized onshore by locating pipeline corridors away from nesting aggregations and/or by scheduling trenching activities to avoid the nesting period.
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 on nesting or colonial species. Mitigation would be achieved through consultation with Federal agencies concerning compliance with the ESA and the MBTA.
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 could 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		
Lighting/Physical Presence		
Onshore Facilities	Minor	Birds are attracted to lights and could be drawn to onshore facilities and other structures. This could lead to energetic costs for individual birds or collisions with platforms or structures. Bird interactions (collisions) occur with onshore structures and vehicles without lighting as well (Erickson et al 2005, Loss et al. 2014a, Loss et al. 2014b). Population level effects are not anticipated; however, any loss of threatened and endangered species, such as eiders, is 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, could minimize light-based impacts.

Impact-Producing Factor	Impact Determination for the Proposed Action	Explanation
Offshore Facilities		Birds are attracted to lights and flares and could be drawn to platforms and vessels (Russell 2005, Montevecchi 2006, Poot et al. 2008, Ronconi et al. 2015). Birds can become disoriented by artificial lights at night, particularly offshore during migration, when they could circle the light source for hours. This increases the risk of collision with vessels and offshore structures and decreases fat reserves (Longcore and Rich 2004, Montevecchi 2006, Weiss et al. 2012). Birds could also be attracted to offshore structures and vessels for a variety of reasons (both advantageous and deleterious) besides light attraction, including attraction to a foreign structure (Baird 1990), increased foraging opportunities for avian predators (Ronconi et al. 2015), roosting sites (Baird 1990, Russell 2005), and for use as rest areas during migration or as temporary shelters during inclement weather (Russell 2005, Ronconi et al. 2015). Russell (2005) estimated the rate of collision with offshore platforms in the GOM to be up to 50 birds per year per platform and there are more than 1,400 active platforms in the GOM. In the Chukchi Sea Program Area, BOEM estimated that annual bird strikes on drillships and support vessels would occur at a minimum rate of 53 birds per drillship and 11 per associated support vessel (BOEM 2014). Losses in the Beaufort Sea and Cook Inlet Program Areas would be expected to be similar to the Chukchi Sea due to the lower levels of activity. Population level effects are not anticipated; however, any loss of threatened and endangered species, such as eiders, is 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 that give off less light could minimize impacts.
Visible Infrastructure		
Onshore	No Impact	No Impact
Offshore		
Space Use Conflicts		
Onshore Facilities	No Impact	No Impact
Offshore Facilities		
Non-Routine Events		
Accidental Spills	Negligible – Major	Refer to **Section 4.4.5** of the Programmatic EIS.
CDE	Minor – Major	

Key: CDE = Catastrophic Discharge Event; ESA = Endangered Species Act; GOM = Gulf of Mexico; LED = Light-Emitting Diode; MBTA = Migratory Bird Treaty Act

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	Impulsive sounds with a very rapid rise and high peak pressure could 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 (Popper and Hastings 2009, Halvorsen et al. 2012). Localized, temporary behavioral response due to hearing loss or masking of biologically important sounds 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	No Impact	This IPF is not expected to affect fish or EFH.
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 would not have an effect on fishes or EFH. USEPA and MARPOL regulations are designed to minimize potential impacts on 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 could 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 can displace benthic feeding fishes from areas used for foraging or resting. Trenching, dredging, or other construction would generate excess turbidity, which could impair respiration, feeding, or reproduction in individuals relying on sight (Kjelland et al. 2015, Wilber and Clarke 2001). Some fish simply move away from turbid waters. Small or less vagile species could be further impaired by high turbidity, though effects vary by species (De Robertis et al. 2014). Such effects would likely be temporary (hours to days) and are not expected to have population-level consequences. Prior to authorizing bottom-disturbing activities, site-specific reviews would be conducted to assess potential impacts, with appropriate protective measures recommended.
Air Emissions		
Onshore/Offshore	No Impact	This IPF is not expected to affect fish or EFH.

Impact-Producing Factor	Impact Determination for the Proposed Action	Explanation
Lighting/Physical Presence		
Lighting (offshore, onshore facilities)	Negligible	Small areas of marine surface waters could be exposed to facility or vessel lighting. Some fish species are attracted to lights at night, but the impacts are unknown in a relatively small number of fish and/or invertebrates. Since the effects would be confined to a small geographic area, few fishes are expected to be impacted with no population-level impacts, so the effect on fishes and EFH would be negligible.
Visible Infrastructure		
Visible Infrastructure (onshore, offshore)	No Impact	This IPF is not expected to affect fish or EFH.
Space-Use Conflicts		
Space-Use Conflicts (onshore, OCS facilities)	No Impact	This IPF is not expected to affect fish or EFH.
Non-Routine Events		
Accidental Spills	Negligible – Moderate	Refer to **Section 4.4.5** of the Programmatic EIS.
CDE	Moderate – Major	

Key: CDE = Catastrophic Discharge Event; EFH = Essential Fish Habitat; IPF = impact-producing factor; MARPOL = International Convention for the Prevention of Pollution from Ships; OCS = Outer Continental Shelf; USCG = United States Coast Guard; USEPA = United States Environmental Protection Agency.

Arctic Terrestrial Wildlife and Habitat

Impact-Producing Factor	Impact Determination for the Proposed Action	Explanation
Noise		
Seismic Noise	No Impact	This IPF is not expected to affect Arctic terrestrial habitats or wildlife.
Ship Noise	No Impact	This IPF is not expected to affect Arctic terrestrial habitats or wildlife.
Aircraft Noise	Minor	Localized disturbance/possible temporary displacement of some species from the immediate area of activity. Some species would avoid noise and activity to a greater degree depending upon the season, others would become acclimatized over time (Wolfe et al. 2008).
Drilling Noise	No Impact	This IPF is not expected to affect Arctic terrestrial habitats or wildlife.
Trenching Noise	No Impact	This IPF is not expected to affect Arctic terrestrial habitats or wildlife.
Production Noise	No Impact	This IPF is not expected to affect Arctic terrestrial habitats or wildlife.
Offshore Construction	No Impact	This IPF is not expected to affect Arctic terrestrial habitats or wildlife.
Onshore Construction	Minor	Localized disturbance/possible temporary displacement of some species from the immediate area of activity. Some species would avoid noise and activity, others would become acclimatized and return to the area for the duration of construction activity (Wolfe et al. 2008).
Platform Removal (includes explosives use)	No Impact	This IPF is not expected to affect Arctic terrestrial habitats or wildlife.
Traffic		
Aircraft Traffic	Minor – Moderate	Refer to **Section 4.4.1.10** of the Programmatic EIS.
Ship/Vessel Traffic	No Impact	This IPF is not expected to affect Arctic terrestrial habitats or wildlife.
Vehicle Traffic	Minor – Moderate	Refer to **Section 4.4.1.10** of the Programmatic EIS.
Routine Discharges		
Sanitary Wastes	No Impact	This IPF is not expected to affect Arctic terrestrial habitats or wildlife.
Gray Water, Misc. Discharges	No Impact	This IPF is not expected to affect Arctic terrestrial habitats or wildlife.
Drilling Mud/Cuttings/Debris	No Impact	This IPF is not expected to affect Arctic terrestrial habitats or wildlife.
Bottom/Land Disturbance		
Drilling	No Impact	This IPF is not expected to affect Arctic terrestrial habitats or wildlife.
Infrastructure Emplacement (other than noise)	Minor (Beaufort Sea) Moderate (Chukchi Sea)	Refer to **Section 4.4.1.10** of the Programmatic EIS. Minor impacts for the Beaufort Sea Program Area since little onshore construction is anticipated as oil and gas infrastructure already exists.
Pipeline Trenching	Minor (Beaufort Sea) Moderate (Chukchi Sea)	Refer to **Section 4.4.1.10** of the Programmatic EIS. Minor impacts for the Beaufort Sea Program Area since little onshore construction is anticipated as oil and gas infrastructure already exists.

Impact-Producing Factor	Impact Determination for the Proposed Action	Explanation
Onshore Construction (other than noise)	Minor (Beaufort Sea) Moderate (Chukchi Sea)	Refer to **Section 4.4.1.10** of the Programmatic EIS. Minor impacts for the Beaufort Sea Program Area since little onshore construction is anticipated as oil and gas infrastructure already exists.
Structure Removal (other than noise)	No Impact	This IPF is not expected to affect Arctic terrestrial habitats or wildlife.
Air Emissions		
Onshore	Negligible	Air emissions are regulated and permitted releases are not anticipated to impact terrestrial mammals.
Offshore	Negligible	Air emissions are regulated and permitted releases are not anticipated to impact terrestrial mammals.
Lighting/Physical Presence		
Onshore Facilities	Minor – Moderate	The area affected is small in comparison to the overall area onshore utilized for foraging and migration of terrestrial wildlife. Daylight prevails for much of the time when the areas are used by most terrestrial animals, so the potential impacts of anthropogenic light are minimized. Some foraging and calving habitat could be lost temporarily, particularly for caribou. The level of displacement is expected to be small in relation to the available foraging area (Fancy 1983). However, physical presence of structures could have up to a moderate effect. Refer to **Section 4.4.1.10** of the Programmatic EIS.
Offshore Facilities	No Impact	This IPF is not expected to affect Arctic terrestrial habitats or wildlife.
Visible Infrastructure		
Onshore	No Impact	This IPF is not expected to affect Arctic terrestrial habitats or wildlife.
Offshore		
Space Use Conflicts		
Onshore Facilities	No Impact	This IPF is not expected to affect Arctic terrestrial habitats or wildlife.
Offshore Facilities		
Non-Routine Events		
Accidental Spills	Negligible – Major	Refer to **Section 4.4.5** of the Programmatic EIS.
CDE		

Key: CDE = Catastrophic Discharge Event; IPF = impact-producing factor

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)	No Impact	This IPF is not expected to affect archaeological and historical resources.
Traffic		
Aircraft and Ship/Vessel Traffic	No Impact	This IPF is not expected to affect archaeological and historical resources.
Routine Discharges		
Routine Discharges (sanitary wastes, gray water, miscellaneous discharges, drilling mud/cuttings/debris)	No Impact	This IPF is not expected to affect archaeological and historical resources.
Bottom/Land Disturbance		
Bottom/Land Disturbance (no archaeological surveys)	Moderate – 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 would be impacted by a proposed activity or the nature and extent of the impact until after the impact has occurred. If impacts were to occur, they would be moderate to major, because of the sensitivity of these resources to seafloor disturbance impacts and resultant loss of irreplaceable cultural information.
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 would be put in place for any potential archaeological or historical resource discovered during the survey.
Air Emissions		
Onshore/Offshore	No Impact	This IPF is not expected to affect archaeological and historical resources.
Lighting/Physical Presence		
Onshore/Offshore facilities	No Impact	See comments regarding Visible Infrastructure.

Impact-Producing Factor	Impact Determination for the Proposed Action	Explanation
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 an NHPA Section 106 process (36 CFR 800).
Offshore		Visible offshore infrastructures would 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 would no longer be eligible for listing on the *National Register*; however, these effects would have to be carefully considered at the project level.
Space-Use Conflicts		
Space-Use Conflicts (onshore, offshore facilities)	No Impact	This IPF is not expected to affect archaeological and historical resources.
Non-Routine Events		
Accidental Spills	Negligible – Moderate	Refer to **Section 4.4.5** of the Programmatic EIS.
CDE		

Key: CDE = Catastrophic Discharge Event; CFR = Code of Federal Regulations; IPF = impact-producing factor; 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: population, income, and associated local/state revenues) Negligible – Minor (Cook Inlet: population, state revenues, GOM) Minor – Moderate (Cook Inlet: local revenues)	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. In addition, revenues resulting from oil and gas activities (often from supporting infrastructure) are very important to some state and local governments. The impacts on local and state populations associated with increased employment from routine activities are expected to be negligible to minor for the Cook Inlet and GOM 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. The impacts on local revenues are anticipated to be negligible to moderate for the Beaufort and Chukchi Seas Program Areas and minor to moderate for Cook Inlet. The impacts on state revenues are anticipated to be negligible to moderate for the Beaufort and Chukchi Seas Program Areas and negligible to minor for the Cook Inlet Program Area.
Non-Routine Events		
Accidental Spills	Minor – Major	Oil spills could have negative impacts on local and state employment and labor income. Refer to **Section 4.4.5** of the Programmatic EIS
CDE	Moderate – Major	

Key: CDE = Catastrophic Discharge Event; GOM = Gulf of Mexico

Land Use and Infrastructure

Impact-Producing Factor	Impact Determination for the Proposed Action	Explanation
Noise		
Seismic Noise	No Impact	This IPF is not expected to affect land use and infrastructure.
Ship Noise		
Aircraft Noise		
Drilling Noise		
Trenching Noise		
Production Noise		
Offshore Construction		
Onshore Construction		
Platform Removal (includes explosives use)		
Traffic		
Aircraft Traffic	No Impact	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 there would be a considerable increase in aircraft traffic or impact onshore land use and infrastructure.
Ship/Vessel Traffic	No Impact	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 would increase number of ships offshore to support oil and gas activities, it is not expected that ship traffic would be inconsistent with onshore land uses and infrastructure.
Routine Discharges		
Sanitary Wastes	No Impact	Sanitary waste is routinely treated by means of a marine sanitation device. Wastewater treatment sludge and other associated wastes would be transported to shore for disposal at an approved facility. As such, it is not anticipated that treatment of wastes onshore would be inconsistent with local land use and infrastructure.
Gray Water, Misc. Discharges	No Impact	This IPF is not expected to affect land use and infrastructure.
Drilling Mud/Cuttings/Debris		This IPF is not expected to affect land use and infrastructure.
Bottom/Land Disturbance		
Drilling	No Impact	This IPF is not expected to affect land use and infrastructure.

Impact-Producing Factor	Impact Determination for the Proposed Action	Explanation
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 would impact onshore land uses and infrastructure.
Onshore Construction (other than noise)	Moderate (Beaufort and Chukchi Seas) Minor – Moderate (Cook Inlet, GOM)	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 would be limited to the proximal area. Structure removal is not expected to impact onshore land use and infrastructure.
Air Emissions		
Onshore	No Impact	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 would 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 would 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 would impact onshore land uses and infrastructure.
Lighting/Physical Presence		
Onshore Facilities	No Impact	Lighting from onshore facilities (e.g., ports, construction facilities, and transportation, processing facilities) would 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 would be inconsistent with onshore land uses and infrastructure.
Offshore Facilities		Lighting from offshore facilities (e.g., platform lighting, construction lighting, MODU) would mostly impact nighttime views. It is not expected that lighting from offshore facilities would be inconsistent with onshore land uses and infrastructure.

Impact-Producing Factor	Impact Determination for the Proposed Action	Explanation
Visible Infrastructure		
Onshore	Minor – Moderate (Beaufort and Chukchi Seas) Minor (Cook Inlet and Gulf of Mexico)	Refer to **Section 4.4.1.13** of the Programmatic EIS for a discussion of the Beaufort Sea and Chukchi Sea Program Areas. Existing offshore platforms are located within various parts of the Cook Inlet and it is not expected that new leasing under the Proposed Action would impact viewsheds. Therefore, visual impacts as a result of the Proposed Action are expected to be minor due to existing oil and gas activities in the Cook Inlet region. Oil and gas activities are not new to the GOM and additional leasing under the Proposed Action is expected to have minor impacts on existing land use and coastal infrastructure.
Offshore		

Impact-Producing Factor	Impact Determination for the Proposed Action	Explanation
Space-Use Conflicts		
Onshore Facilities Offshore Facilities	Minor – Moderate (Beaufort and Chukchi Seas) Minor (Cook Inlet and Gulf of Mexico)	Refer to **Section 4.4.1.13** of the Programmatic EIS for a discussion of the Beaufort Sea and Chukchi Sea Program Areas. There are no known military or NASA use restrictions such as danger zones or restricted areas in the waters of the Cook Inlet Program Area. The closest military danger zone to the Cook Inlet Program Area is Blying Sound, east of Cook Inlet in the Gulf of Alaska and near the entrance to Prince William Sound. Any practice firing that occurs within Blying Sound requires 7 days of advance notice to the public and at least 48-hours' notice to the USCG and all mariners. As such, space-use conflicts are expected to be minor as it is not anticipated that oil and gas operations would conflict with USDOD operations in the Cook Inlet Program Area. In the event that conflicts do arise, the USDOD and USDOI have historically coordinated to minimize conflicts from oil and gas leasing with defense-related activities. While development of new facilities and infrastructure under the Proposed Action would impact land uses, it is not expected that these activities would result in a considerable change to existing land use patterns. Space-use conflicts have the potential to be greater offshore, where there are competing uses of the OCS not limited to tourism and recreational uses, fisheries production, commercial shipping, and military uses. While these military operations range in scope, the USDOI has coordinated with the USDOD on oil and gas leasing issues, and the two agencies have developed mitigation measures and lease stipulations to minimize potential for conflicts. BOEM also has coordinated with other Federal and state agencies regarding Areas of Special Concern, including NMSs, NPs, and MPAs. BOEM recognizes that many of these special areas, as well as adjacent areas, serve as critical habitat or wildlife corridors and has developed mitigation measures and lease stipulations, or in some cases excluded areas from leasing, to protect these areas. Thus, given the history of oil and gas leasing activities in the GOM and the well-established network of facilities to support these activities, space-use conflicts onshore and offshore are expected to be minor.

Impact-Producing Factor	Impact Determination for the Proposed Action	Explanation
Non-Routine Events		
Accidental Spills	Minor – Moderate	Refer to **Section 4.4.5** of the Programmatic EIS.
CDE	Minor – Major	

Key: CDE = Catastrophic Discharge Event; FAA = Federal Aviation Administration; GOM = Gulf of Mexico; IPF = impact-producing factor; MPA = Marine Protected Area; MODU = Mobile Offshore Drilling Unit; NAAQS = National Ambient Air Quality Standards; NASA = National Aeronautics and Space Administration; NMS = National Marine Sanctuary; NP = National Park; OCS = Outer Continental Shelf; USCG = United States Coast Guard; USDOD = United States Department of Defense; USDOI = United States Department of Interior; 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 because noise is short-term and transient in nature compared to overall available fish habitat. Impulsive sounds with a very rapid rise and high peak pressure could 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 and has not been shown to impact fishing success (Popper and Hastings 2009, Halvorsen et al. 2012). Localized, temporary behavioral response due to hearing loss or masking of biologically important sounds 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.
Ship Noise	Negligible	Localized, temporary behavioral response due to hearing loss or masking of biologically important sounds 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.
Aircraft Noise	No Impact	This IPF is not expected to affect commercial and recreational fisheries.
Drilling Noise	Minor	Drilling noise is spatially limited and is not expected to displace fishing activity (Dalen 2007).
Trenching Noise	Negligible – Minor	This noise should be localized and is not expected to displace fishing activity.
Production Noise	No Impact	This IPF is not expected to affect commercial and recreational fisheries.
Offshore Construction	Negligible	Could promote short-term avoidance, but following activity, it is likely fishing would return to the area. Bottom disturbances as a result of offshore construction can displace benthic feeding fishes from areas used for foraging or resting that are primarily targeted by fisheries participants. Trenching, dredging, or other construction all have the potential to impact fisheries landings because they generate excess turbidity, which could impair respiration, feeding, or reproduction in individuals relying on sight (Kjelland et al. 2015, Wilber and Clarke 2001). Effects vary by species and fishery sectors would not be impacted equally (De Robertis et al. 2014). Such effects would likely be temporary (hours to days) and are not expected to have population-level consequences. Prior to authorizing offshore construction activities, site-specific reviews would be conducted to assess potential impacts, with appropriate protective measures recommended. Additionally, once the structure is in place, it could serve as additional habitat and open up opportunities for other fishing types (White et al. 2012).

Impact-Producing Factor	Impact Determination for the Proposed Action	Explanation
Onshore Construction	No Impact	This IPF is not expected to affect commercial and recreational fisheries.
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	No Impact	This IPF is not expected to affect commercial and recreational fisheries.
Ship/Vessel Traffic		
Routine Discharges		
Sanitary Wastes	No Impact	This IPF is not expected to affect commercial and recreational fisheries.
Gray Water, Misc. Discharges	Negligible	Negligible due to existing discharge regulations that protect fisheries by upholding water quality standards. Permitted discharges are not expected to persist in the water column after discharge. Existing regulations are designed to minimize potential impacts on water quality.
Drilling Mud/Cuttings/Debris		Discharges of production wastes are regulated. Drilling muds are generally recycled and reused. According to Neff (2005), discharged drilling mud does not increase to high concentrations in the water column and affects only a small parcel of water and Neff et al. (2000) have shown that the majority of cuttings settle rapidly to the seafloor and would cover an 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 would be some temporary loss of benthic foraging habitat until re-colonization occurs, which could take several years.

Impact-Producing Factor	Impact Determination for the Proposed Action	Explanation
Bottom/Land Disturbance		
Drilling	Negligible – Minor	Bottom disturbances can displace benthic feeding fishes from areas used for foraging or resting. Trenching, dredging, or other construction would generate excess turbidity, which could impair respiration, feeding, or reproduction in individuals relying on sight (Kjelland et al. 2015, Wilber and Clarke 2001). Some fish would simply move away from turbid waters. Small or less vagile species could be further impaired by high turbidity, though effects vary by species (De Robertis et al. 2014). Such effects would likely be temporary (hours to days) and are not expected to have population-level consequences. Prior to authorizing bottom-disturbing activities, site-specific reviews would be conducted to assess potential impacts, with appropriate protective measures recommended.
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)	No Impact	This IPF is not expected to affect commercial and recreational fisheries.
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	No Impact	This IPF is not expected to affect commercial and recreational fisheries.
Offshore		
Lighting/Physical Presence		
Onshore Facilities	No Impact	This IPF is not expected to affect commercial and recreational fisheries.
Offshore Facilities	Negligible	Some fishers could 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 (Keenan et al. 2007).
Visible Infrastructure		
Onshore	No Impact	This IPF is not expected to affect commercial and recreational fisheries.
Offshore		
Space Use Conflicts		
Onshore Facilities	No Impact	This IPF is not expected to affect commercial and recreational fisheries.

Impact-Producing Factor	Impact Determination for the Proposed Action	Explanation
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 would not be appreciably reduced due to the low number of structures that could be emplaced relative to the overall area of the OCS.
Non-Routine Events		
Accidental Spills	Negligible – Major	Refer to **Section 4.4.5**.
CDE	Moderate – Major	

Key: CDE = Catastrophic Discharge Event; IPF = impact-producing factor; OCS = Outer Continental Shelf

Tourism and Recreation

Impact-Producing Factor	Impact Determination for the Proposed Action	Explanation
Noise		
Noise	Negligible – Moderate (GOM and Cook Inlet) Minor – Moderate (Beaufort and Chukchi Seas)	Refer to **Section 4.4.1.15** of the Programmatic EIS.
Traffic		
Aircraft and Ship/Vessel Traffic	Negligible – Minor	The increased traffic would have a negligible to minor impact in the Beaufort Sea and Chukchi Sea Program Areas because increased traffic would occur due to construction efforts, which would be temporary in nature. In the Cook Inlet and GOM, the impact of increased traffic due to the Proposed Action on tourism would be negligible due to a higher level of background activity, and the small incremental contribution of the Proposed Action to total traffic.
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.
Bottom/Land Disturbance		
Bottom/Land Disturbance (drilling, infrastructure emplacement, pipeline trenching, construction, structure removal)	No Impact	This IPF is not expected to affect 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 would have a discernable impact.
Lighting/Physical Presence		
Lighting (onshore, offshore facilities)	Negligible–Moderate (GOM and Cook Inlet) Minor – Moderate (Beaufort and Chukchi Seas)	Refer to **Section 4.4.1.15** of the Programmatic EIS.

Visible Infrastructure		
Onshore Facilities	Negligible – Moderate (GOM and Cook Inlet) Minor – Moderate (Beaufort and Chukchi Seas)	Refer to **Section 4.4.1.15** of the Programmatic EIS.
Offshore Facilities		
Visible Infrastructure (onshore, offshore)	Negligible (GOM and Cook Inlet) Minor (Beaufort and Chukchi Seas)	While onshore activity is outside BOEM jurisdiction, it is assumed that state and local officials would 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, effects are expected to be widely distributed, and would not change the already existing infrastructure in the GOM. Existing levels of infrastructure 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 4.4.5** of the Programmatic EIS.
CDE	Moderate – Major	

Key: CDE = Catastrophic Discharge Event; E&D = Exploration and Development; GOM = Gulf of Mexico; IPF = impact producing factor; 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 (Cook Inlet and GOM) Minor – Moderate (Beaufort and Chukchi Seas)	Seismic noise in the Cook Inlet and GOM is expected to produce a negligible or minor impact on sociocultural systems due to the location of seismic operations relative to sociocultural systems resources and/or the species present. Refer to **Section 4.4.1.16** of the Programmatic EIS for a discussion of the Beaufort Sea and Chukchi Sea program areas.
Ship Noise		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 for the Cook Inlet and GOM program areas. Refer to **Section 4.4.1.16** of the Programmatic EIS for a discussion of the Beaufort Sea and Chukchi Sea program areas.
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 for the Cook Inlet and GOM program areas. Refer to **Section 4.4.1.16** of the Programmatic EIS for a discussion of the Beaufort Sea and Chukchi Sea program areas.
Drilling Noise		Noise from drilling operations would be restricted to the offshore environment. In the Cook Inlet and GOM, drilling noise is expected to produce negligible to minor impacts on sociocultural systems. Refer to **Section 4.4.1.16** of the Programmatic EIS for a discussion of the Beaufort Sea and Chukchi Sea program areas.
Trenching Noise	Minor	See discussion of drilling noise, above.
Production Noise		Production noise has been at minor levels in the Cook Inlet and GOM for many years and would be expected to be the same in the Beaufort Sea and Chukchi Sea Program Areas.
Onshore Construction	Negligible – Minor (Cook Inlet and GOM) Minor – Moderate (Beaufort and Chukchi Seas)	This noise should be very localized and proximate to existing infrastructure and therefore negligible in the Cook Inlet and GOM. Refer to **Section 4.4.1.16** of the Programmatic EIS for a discussion of the Beaufort Sea and Chukchi Sea program areas.
Offshore Construction		

Impact-Producing Factor	Impact Determination for the Proposed Action	Explanation
Platform Removal (includes explosives use)	Negligible – Minor (Cook Inlet and GOM) Minor – Moderate (Beaufort and Chukchi Seas)	Noise associated with platform removal in the Cook Inlet and GOM is expected to produce a negligible or minor impact on sociocultural systems due to the location of removal operations relative to sociocultural systems resources and/or the species present. Refer to **Section 4.4.1.16** of the Programmatic EIS for a discussion of the Beaufort Sea and Chukchi Sea program areas.
Traffic		
Ship/Vessel Traffic	Negligible (Cook Inlet, GOM) Moderate – Major (Beaufort and Chukchi Seas)	In the Cook Inlet and GOM, ship and vessel traffic would have only a negligible impact on sociocultural systems because the traffic increase would not be measurably different than the baseline. Refer to **Section 4.4.1.16** of the Programmatic EIS for a discussion of the Beaufort Sea and Chukchi Sea program areas.
Aircraft Traffic	Negligible – Minor	In the Cook Inlet and GOM, aircraft traffic would have only a negligible impact because the traffic increase would 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 whales) activity patterns and duration of aircraft activity.
Routine Discharges		
Sanitary Wastes	Minor	Sanitary wastes, as well as other routine discharges, would not persist in the water column after discharge for all program areas.
Gray Water, Misc. Discharges		
Drilling Mud/Cuttings/Debris	Minor (Cook Inlet, GOM) Moderate (Beaufort and Chukchi Seas)	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 would be negligible.
Infrastructure Emplacement (other than noise)		
Pipeline Trenching		

Impact-Producing Factor	Impact Determination for the Proposed Action	Explanation
Onshore Construction (other than noise)	Negligible (Cook Inlet and GOM) Moderate – Major (Beaufort and Chukchi Seas)	The effects of onshore construction on sociocultural systems would be negligible in the Cook Inlet and GOM because there is already sufficient infrastructure to tie into that there would 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 Sea Program Areas.
Structure Removal (other than noise)		The effects of structure removal on sociocultural systems is considered to be negligible in the Cook Inlet and GOM because there is already sufficient activity there would 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 would not adversely affect subsistence and recreational fishing activities or other sociocultural systems resources. Consequently, only negligible impacts on sociocultural systems are expected.
Offshore		
Lighting/Physical Presence		
Onshore Facilities	Negligible	Lighting would not have any measureable effect on sociocultural systems above existing conditions; overall impact of onshore/offshore lighting would be negligible.
Offshore Facilities		
Visible Infrastructure		
Onshore	Negligible – Minor (Cook Inlet and GOM) Moderate – Major (Beaufort and Chukchi Seas)	Onshore visible infrastructure has existed in the Cook Inlet and GOM 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. In the Cook Inlet and GOM, expected infrastructure would tie into existing infrastructure. Therefore, the impact of this IPF would be negligible in the Cook Inlet and GOM. See **Section 4.4.1.16** of the Programmatic EIS for a discussion of the Beaufort and Chukchi Seas Program Areas.
Offshore	Negligible – Minor (Cook Inlet and GOM) Moderate – Major (Beaufort and Chukchi Seas)	Visible offshore infrastructure in the GOM and Cook Inlet has been present for several decades; impacts of visible infrastructure are expected to range from negligible to minor. 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
Space Use Conflicts		
Onshore Facilities	Negligible (Cook Inlet and GOM) Moderate – Major (Beaufort and Chukchi Seas)	Existing infrastructure in the Cook Inlet and GOM, and the low number of potential facilities associated with these program areas makes it unlikely that there would 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.
Offshore Facilities	Negligible (Cook Inlet and GOM) Moderate – Major (Beaufort and Chukchi Seas)	The impacts of onshore facilities would be localized and would not result in a noticeable change over the existing conditions in the GOM and Cook Inlet 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 4.4.5** of the Programmatic EIS.
CDE	Moderate – Major	

Key: CDE = Catastrophic Discharge Event; GOM = Gulf of Mexico; 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, GOM)	Subsea surface noise will not produce a direct impact on vulnerable communities onshore, but could affect their subsistence harvests nearshore. In the GOM, 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, GOM)	
Trenching Noise		
Production Noise		
Offshore Construction		
Onshore Construction	Minor – Major (Beaufort and Chukchi Seas) Minor (Cook Inlet, GOM)	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 GOM 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	Refer to noise discussion.	Impacts from aircraft or ship/vessel traffic are addressed under noise impacts.
Ship/Vessel Traffic		
Routine Discharges		
Sanitary Wastes	Negligible – Moderate (Beaufort and Chukchi Seas) Negligible – Minor (Cook Inlet, GOM)	Routine (permitted) offshore discharges are unlikely to directly impact vulnerable communities onshore, but could affect their subsistence harvests nearshore. In the GOM, 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, GOM)	
Drilling Mud/Cuttings/Debris		
Bottom/Land Disturbance		
Drilling	Negligible (GOM) Minor (Cook Inlet) Negligible – Moderate (Beaufort and Chukchi Seas)	Vulnerable communities in the Beaufort Sea and Chukchi Sea Program Areas could be indirectly affected by an impact to subsistence harvests. Drilling, infrastructure emplacement, pipeline trenching, and structural removal are unlikely to affect subsistence use GOM Program Area, as well as the Cook Inlet Program Area, due to industry history and presence in the GOM and Cook Inlet. Refer to **Section 4.4.1.17** of the Programmatic EIS.
Infrastructure Emplacement (other than noise)		
Pipeline Trenching		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. Refer to **Section 4.4.1.17** of the Programmatic EIS.

Impact-Producing Factor	Impact Determination for the Proposed Action	Explanation
Onshore Construction (other than noise)	Negligible – Minor (GOM) Minor (Cook Inlet) Moderate – Major (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 (GOM) 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 GOM, 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.
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 GOM and Cook Inlet. Impacts to vulnerable communities in these areas are expected to be minor. In the Beaufort Sea and Chukchi Sea Program Areas, there is little industry infrastructure and activity, as compared to the GOM (**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.

Impact-Producing Factor	Impact Determination for the Proposed Action	Explanation
Offshore Facilities	Negligible	In the GOM, 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 Sea and Chukchi Sea Program 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 (GOM) Minor (Cook Inlet) Moderate (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.
Offshore	Negligible (GOM) 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 GOM. 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 (GOM) Minor – Moderate (AK)	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 GOM. 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 (Cook Inlet, GOM) Moderate – Major (Beaufort and Chukchi Seas)	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 GOM, 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.

Impact-Producing Factor	Impact Determination for the Proposed Action	Explanation
Non-Routine Events		
Accidental Spills	Minor – Major	Refer to **Section 4.4.**5 of the Programmatic EIS.
CDE		

Key: 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.

References

Andersen, D.E., O.J. Rongstad, W.R. Mytton. 1989. Response of Nesting Red-Tailed Hawks to Helicopter Overflights. The Condor 91:296-299.

Baird, P.H. 1990. Concentrations of Seabirds at Oil-Drilling Rigs. The Condor 92:768-771.

Black, B.B., M.W. Collopy, H.F. Percival, A.A. Tiller, P.G. Bohall. 1984. Technical Report No. 7: Effects of Low Level Military Training Flights on Wading Bird Colonies in Florida. Prepared for the U.S. Air Force, Department of Command Natural Resources, Headquarters Tactical Air Command, Langley Air Force Base, Virigina.

BOEM. 2014. Chukchi Sea Planning Area, Oil and Gas Lease Sale 193 in the Chukchi Sea, Alaska. Draft Second Supplemental Environmental Impact Statement, Volume 1, Chapters 1-6 (Section 3.3.1.). OCS EIS/EA BOEM 2014-653.

Brown, B.T., G.S. Mills, C. Powels, W.A. Russell, G.D. Therres, J.J. Pottie. 1999. The Influence of Weapons-Testing Noise on Bald Eagle Behavior. Journal of Raptor Research 33(3): 227-232.

CSA. 2004. Gulf of Mexico Comprehensive Synthetic Based Muds Monitoring Program, Technical Report, Vol. 1, prepared for the Synthetic Based Muds Research Group.

CSA. 2006. Effects of Oil and Gas Exploration and Development at Selected Continental Slope Sites in the Gulf of Mexico. Volume II: Technical Report. U.S. Department of the Interior, Minerals Management Service, Gulf of Mexico OCS Region, New Orleans, LA. OCS Study MMS 2006-045. 636 pp. Available online at http://www.data.boem.gov/PI/PDFImages/ESPIS/3/3875.pdf. Accessed August 18, 2016.

Dalen, J. 2007. Effects of Seismic Surveys on Fish, Fish Catches, and Sea Mammals. Report for the Cooperation Group – Fishing Industry and Petroleum Industry Report No. 2007-0512. April 24, 2007.

De Robertis, A., D. McKelvey, K. Taylor, T. Honkalehto. 2014. Development of Acoustic-Trawl Survey Methods to Estimate the Abundance of age-0 Walleye Pollock in the Eastern Bering Sea Shelf during the Bering Arctic Subarctic Integrated Survey. NOAA Technical Memorandum NMFS-AFSC-272. March 2014.

Delaney, D.K., T.G. Grubb, P. Beier, L.L. Pater, M.H. Reiser. 1999. Effects of Helicopter Noise on Mexican Spotted Owls. Journal of Wildlife Management 63(1): 60-76.

Dooling, R.J., A.N. Popper. 2007. The Effects of Highway Noise on Birds. Prepared for the California Department of Transportation. September 30, 2007.

Ellis, D.H., C.H. Ellis, D.P. Mindell. 1991. Raptor Responses to Low-Level Jet Aircraft and Sonic Booms. Environmental Pollution 74: 53-83.

Erickson, W.P., G.D. Johnson, D.P. Young. 2005. A summary and comparison of bird mortality from anthropogenic causes with an emphasis on collisions. In: Ralph, C.J, T.D. Rich, editors. Bird Conservation Implementation and Integration in the Americas: Proceedings of the Third International Partners in Flight Conference. 2002 March 20-24; Asilomar, California, Volume 2 Gen. Tech. Rep. PSW-GTR-191. Albany, CA: U.S. Dept. of Agriculture, Forest Service, Pacific Southwest Research Station: p. 1029-1042.

Fancy, S.G. 1983. Movements and activity budgets of caribou near oil drilling sites in the Sagavanirktok River floodplain, Alaska. Arctic, pp.193-197.

Gallaway, B.J., J.G. Cole, and L.R. Martin. 2008. Platform debris fields associated with the Blue Dolphin (Buccaneer) Gas and Oil Field artificial reef sites offshore Freeport, Texas: Extent, composition, and biological utilization. U.S. Dept. of the Interior, Minerals Management Service, Gulf of Mexico OCS Region, New Orleans, LA. OCS Study MMS 2008-048. 112 pp.

Halvorsen, M.B., D.G. Zeddies, W.T. Ellison, D.R. Chicoine, and A.N. Popper. 2012. Effects of mid-frequency active sonar on hearing in fish. The Journal of the Acoustical Society of America 131, no. 1: 599-607.

Holles S, Simpson SD, Radford AN, Berten L, Lecchini D. 2013. Boat noise disrupts orientation behaviour in a coral reef fish. Mar Ecol Prog Ser 485:295-300.

Houser, C. 2010. Relative importance of vessel-generated and wind waves to salt marsh erosion in a restricted fetch environment. Journal of Coastal Research. 26:230-240.

Kaiser, M.J. 2015. Offshore service vessel activity forecast and regulatory modeling in the U.S. Gulf of Mexico, 2012-2017. Marine Policy. 57:132-146.

Keenan, S.F., M.C. Benfield, J.K. Blackburn. 2007. Importance of the Artificial Light Field Around Offshore Petroleum Platforms for the Associated Fish Community. Marine Ecology Progress Series, Vol. 331: 219-231.

Kjelland, M.E., C.M. Woodley, T.M. Swannack, D.L. Smith. 2015. A Review of the Potential Effects of Suspended Sediment on Fishes: Potential Dredging-Related Physiological, Behavioral, and Transgenerational Implications. Envivon. Syst. Decis (2015) 35: 334-350. July 2015.

Komenda-Zehnder, S., M. Cevallos, B. Bruderer. 2003. Effects of Disturbance by Aircraft Overflight on Waterbirds – An Experimental Approach. International Bird Strike Committee. IBSC26/WP-LE2. Warsaw, 5-9 May 2003.

Lacroix, D.L., R.B. Lanctot, J.A. Reed, T.L. McDonald. 2003. Effect of Underwater Seismic Surveys on Molting Male Long-tailed Ducks in the Beaufort Sea, Alaska. Canadian Journal of Zoology 81: 1862-1875.

Longcore, T. and Rich, C. 2004. Ecological light pollution. Frontiers in Ecology and the Environment, 2: 191–198.

Loren C. Scott and Associates. 2008. The Economic Impacts of Port Fourchon on the National and Houma MSA Economies. Louisiana Economic Development and South Louisiana Economic Council. 28 pp.

Loss, S. R., Will, T., & Marra, P.P. 2014a. Estimation of bird vehicle collision mortality on US roads. The Journal of Wildlife Management. 78(5), 763-771.

Loss, S. R., Will, T., Loss, S. S., & Marra, P.P. 2014b. Bird-building collisions in the United States: Estimates of annual mortality and species vulnerability. The Condor. 116(1), 8-23.

Montevecchi, W.A. 2006. Ecological Consequences of Artificial Night Lighting. Island Press. Washington, D.C.

Moriyasu, M., R. Allain, K. Benhalima, and R. Claytor. 2004. Effects of seismic and marine noise on invertebrates: A literature review. Canadian Science Advisory Secretariat, Fisheries and Oceans Canada. Research Document 2004/126. ISSN 1499-3848.

Nedelec S.L., S.D. Simpson, E.L. Morley, B. Nedelec, A.N. Radford. 2016. Impacts of Regular and Random Noise on the Behavior, Growth, and Development of Larval Atlantic Cod (Gadus Morhua). Proc. R. Soc. B 282: 20151943.

Neff, J.M. 2005. Composition, Environmental Fates, and Biological Effects of Water-Based Drilling Muds and Cuttings Discharged to the Marine Environment: A Synthesis and Annotated Bibliography. Prepared for Petroleum Environmental Research Forum (PERF) and American Petroleum Institute. 83 pp.

Neff, J.M., S. McKelvie and R.C. Ayers, Jr. 2000. Environmental impacts of synthetic based drilling fluids. Report prepared for MMS by Robert Ayers & Associates, Inc. August 2000. Gulf of Mexico OCS Region, New Orleans, LA. OCS Study MMS 2000- 064. 118 pp.

O'Sullivan, J.B. 1961. Quaternary geology of the Arctic Coastal Plain, northern Alaska. Retrospective Theses and Dissertations. Paper 1980. Iowa State University.

Poot, H., B.J. Ens, H. de Vries, M.A.H. Donners, M.R. Wernand, J.M. Marquenie. 2008. Green Light for Nocturnally Migrating Birds. Ecology and Society 13(2) 47.

Popper, A.N., M. Salmon and K.W. Horch. 2001. Acoustic detection and communication by decapod crustaceans. J. Comparative Physiology 187: 83-89. DOI 10.1007/s003590100184.

Popper, A.N., M.C. Hastings. 2009. The Effects of Anthropogenic Sources of Sound on Fishes. Journal of Fish Biology (2009) 75, pp. 455-489.

Radford, A. N., Lèbre, L., Lecaillon, G., Nedelec, S. L., & Simpson, S. D. (2016). Repeated exposure reduces the response to impulsive noise in European seabass. Global Change Biology.Ronconi, R.A., K.A. Allard, and P.D. Taylor. 2015. Bird interactions with offshore oil and gas platforms: Review of impacts and monitoring techniques. Journal of Environmental Management 147: 34-45.

Russell, R.W. 2005. Interactions between Migrating Birds and Offshore Oil and Gas Platforms in the Northern Gulf of Mexico: Final Report. U.S. Department of the Interior, Minerals Management Service, Gulf of Mexico OCS Region, New Orleans, LA. OCS Study MMS 2005-009. 348 pp.

Stemp, R. 1985. Observations of the Effects of Seismic Exploration on Seabirds. Proceedings of the Workshop on Effects of Explosives Use in the Marine Environment. January 29-31, 1985. Halifax.

Tasker, M.L., P.H. Jones, B.F. Blake, T.J. Dixon, A.W. Wallis. 1986. Seabirds Associated with Oil Production Platforms in the North Sea. Ringing & Migration 7:1, 7-14.

Wale MA, S.D. Simpson, A.N. Radford. 2013. Noise negatively affects foraging and antipredator behaviour in shore crabs. Anim. Behav. 86, 111– 118. doi:10.1016/j.anbehav.2013.05.001.

Weiss, A., S. Van der Graaf, D. Stoppelenburg, H-P. Damian. 2012. Report of the OSPAR Workshop on Research into Possible Effects of Regular Platform Lighting on Specific Bird Populations. OSPAR Commission 2012.

White, H.K., P-Y. Hsing, W. Cho, T.M. Shank, E.E. Cordes, A.M. Quattrini, R.K. Nelson, R. Camilli, A.W.J. Demopouls, C.R. German, J.M. Brooks, H.H. Roberts, W. Shedd, C.M. Reddy, C.R. Fisher. 2012. Impact of the Deepwater Horizon Oil Spill on a Deep-Water Coral Community in the Gulf of Mexico. PNAS 109(50) 20303-20308.

Dara H. Wilber & Douglas G. Clarke (2001) Biological Effects of Suspended Sediments: A Review of Suspended Sediment Impacts on Fish and Shellfish with Relation to Dredging Activities in Estuaries, North American Journal of Fisheries Management, 21:4, 855-875, DOI: 10.1577/1548-8675(2001)0212.0.CO;2

Wolfe, S.A., B. Griffith, and C.A.G. Wolfe. 2000. Response of reindeer and caribou to human activities. Polar Research, 19(1), pp.63-73.

This page intentionally left blank

Appendix F

References for the Programmatic EIS, Volume I

This page intentionally left blank

ABS (American Bureau of Shipping Consulting, Inc). 2016. 2016 Update of Occurrence Rates for Offshore Oil Spills. Contract # E15PX00045, Report to the Oil Spill Preparedness Division of the Bureau of Safety and Environmental Enforcement.

ADCCED (Alaska Department of Commerce, Community, and Economic Development). 2015. Economic Impacts of Alaska's Visitor Industry, 2013-14 Update. Prepared by the McDowell Group. 9 pp.

ADCCED. 2016a. Alaska Taxable 2015. Office of the State Assessor, Department of Commerce, Community, and Economic Development . 103 pp.

ADCCED. 2016b. Economic Impacts of Alaska's Visitor Industry, 2014-15 update. Prepared by the McDowell Group. 8 pp.

ADEC (Alaska Department of Environmental Conservation). 2013. Final 2012 Integrated Water Quality Monitoring and Assessment Report. 161 pp.

ADF&G. 2008. Turtle. Fact Sheet, Alaska Department of Fish and Game. Available online at https://www.adfg.alaska.gov/static/education/wns/turtles.pdf.

ADF&G. 2014. Brown bear annual survey and inventory: The status of brown bears and factors influencing their populations. Division of Wildlife Conservation, Federal Aid Annual Performance Report 1 July 2013–30 June 2014, Federal Aid in Wildlife Restoration Project 4.0, Juneau.

ADF&G. 2015. Special Status Species. Available online at http://www.adfg.alaska.gov/index.cfm?adfg =specialstatus.main. Accessed August 8, 2016.

ADF&G. 2016. 2015 Calendar Year Licenses and Tags Issued. Alaska Department of Fish and Game. Alaska Department of Fish and Game, Division of Administrative Services, Licensing and Accounting. January 8, 2016.

ADLWD (Alaska Department of Labor and Workforce Development). 2016. Alaska Local and Regional Information. Available online at http://live.laborstats.alaska.gov/alari/details.cfm?yr=2014&dst=01&dst=03&dst=04&dst=02&dst=06&dst=09&dst=07&r=0&b=0&p=0. Accessed August 12, 2016.

ADNR (Alaska Department of Natural Resources). 2008. North Slope Areawide Oil and Gas Lease Sale: Final Best Interest Finding. Prepared by Alaska Department of Natural Resources, Division of Oil and Gas, Anchorage, Alaska.

ADNR. 2009. Chapter 3: Description of the Cook Inlet Lease Sale Area. Cook Inlet Areawide Oil and Gas Lease Sale: Final Finding of the Director. Prepared by Alaska Department of Natural Resources, Division of Oil and Gas, Anchorage, Alaska.

ADNR. 2015a. Five-Year Program of Proposed Oil and Gas Lease Sales with Reports on Exploration Licensing, Geothermal Lease Sales, Financial Incentives, and Tax Credit Programs. Prepared by the Department of Natural Resources, Division of Oil and Gas.

ADNR. 2015b. State of Alaska Division of Oil and Gas 2014 Annual Report. January 2015. Juneau, AK: ADNR, Division of Oil and Gas.

ADNR. 2016a. Active Oil and Gas Lease Inventory (August 4, 2016). Available online at http://dog.dnr.alaska.gov/Publications/OGInventory.htm. Accessed August 19, 2016.

ADNR. 2016b. North Slope Oil and Gas Activity, as of May 2016. Alaska Department of Natural Resources, Division of Oil and Gas.

ADNR. 2016c. Cook Inlet Oil and Gas Activity as of May 2016. Alaska Department of Natural Resources, Division of Oil and Gas.

ADNR. 2016d. Cook Inlet Lease Ownership (June 2016). Available online at http://dog.dnr.alaska.gov/Leasing/Documents/NotificationLesseeMaps/CookInlet-NotificationLesseeMap-201606.pdf. Accessed August 19, 2016.

Aerts, L.A.M., A.E. McFarland, B.H. Watts, K.S. Lomac-MacNair, P.E. Seiser, S.S. Wisdom, A.V. Kirk, and C.A. Schudel. 2013. Marine mammal distribution and abundance in an offshore sub-region of the northeastern Chukchi Sea during the open-water season. Continental Shelf Research 67:116-126.

AEWC (Alaska Eskimo Whaling Commission). 2016. Barrow, Alaska. Available online at http://www.aewc-alaska.com/whaling-villages.html. Accessed August 18, 2016.

Agardy, M.T. 1990. Preliminary assessment of the impacts of Hurricane Hugo on sea turtle populations of the eastern Caribbean. In: Richardson, T.H., J.I. Richardson, and M. Donnelly, comps. Proceedings of the 10th Annual Workshop on Sea Turtle Biology and Conservation, February 20-24, Hilton Head Island, SC. NOAA Technical Memorandum NMFS-SEFSC-278.

Agler, B.A., P.E. Seiser, S.J. Kendall, and D.B. Irons. 1995. Winter marine bird and sea otter abundance of Prince William Sound, Alaska: trends following the T/V Exxon Valdez oil spill from 1990-94. Restoration Project 84159. *Exxon Valdez* Oil Spill Restoration Final Report, U.S. Fish and Wildlife Service, Anchorage, Alaska. 87 pp.

Aguilera, F., J. Mendez, E. Pasaro, and B. Laffon. 2010. Review on the Effects of Exposure to Spilled Oils on Human Health. Journal of Applied Toxicology 30:291–301.

Ahtuangaruak, Rosemary. 2015. Broken Promises: The Future of Arctic Development and Elevating the Voices of Those Most Affected by It – Alaska Natives. Available online at http://www.tandfonline.com/loi/rpgi20. Accessed August 3, 2016.

Alexander-Bloch, Benjamin. 2010. Vietnamese-American fishers fight for oil spill claim approval. New Orleans Times-Picayune. December 15, 2010. Available online at http://www.nola.com/news/gulf-oil-spill/index.ssf/2010/12/vietnamese-american_fishermen.html. Accessed December 15, 2015.

Alkire, M.B., and J.H. Trefry. 2006. Transport of spring floodwater from rivers under ice to the Alaskan Beaufort Sea. J. Geophys. Res., 111, C12008, doi:10.1029/2005JC003446.

Allan S.E., B.W. Smith, and K.A. Anderson. 2012. Impact of the Deepwater Horizon Oil Spill on Bioavailable Polycyclic Aromatic Hydrocarbons in Gulf of Mexico Coastal Waters. Environmental Science & Technology 46(4):2033-9.

Almeda, R., Z. Wambaugh, Z. Wang, C. Hyatt, Z. Liu, and E.J. Buskey. 2013. Interactions between zooplankton and crude oil: toxic effects and bioaccumulation of polycyclic aromatic hydrocarbons. PLoS ONE. June 2013, Volume 8, Issue 6, e67212.

Alyeska Pipeline Service Company. 2013. FACTS, Trans Alaska Pipeline System; A collection of facts compiled over the duration of the operation of the Trans Alaska Pipeline System.

AMAP (Arctic Monitoring and Assessment Programme). 2009. AMAP Assessment 2009: Human Health in the Arctic. Arctic Monitoring and Assessment Programme, Oslo, Norway. Available online at http://www.amap.no/documents/download/1163. Accessed December 11, 2015.

Anderson, C.M., M. Mayes, and R.P. LaBelle. 2012. Oil Spill Occurrence Rates for Offshore Spills. Herndon, VA. Bureau of Ocean Energy Management Division of Environmental Assessment, OCS Report 2012-069, and Bureau of Safety and Environmental Enforcement, Report No. 2012-069. 76 pp. Andres, B.A., P.A. Smith, R.I.G. Morrison, C.L. Gratto-Trevor, S.C. Brown, and C.A. Friis. 2012. Population estimates of North American shorebirds, 2012. Wader Study Group Bulletin 119(3): 178–194.

Anderson, C.M., M. Mayes, and R.P. LaBelle. 2012. Oil Spill Occurrence Rates for Offshore Spills. BOEM OCS Report 2012-069, and BSEE Report No. 2012-069. 76 pp.

Angerbjorn, A., B. Arvidson, E. Noren, and L. Stromgren. 1991. The effect of winter food on reproduction in the arctic fox, *Alopex Lagopus*: A field experiment. Journal of Animal Ecology 60:705-714.

Anthony, R.M., N.M. Barten, and P.E. Seiser. 2000. Foods of arctic foxes (*Alopex lagopus*) during winter and spring in western Alaska. Journal of Mammalogy 813:820- 828.

AOGA (Alaska Oil and Gas Association). 2015. AOGA Fact Sheet: Cook Inlet Oil & Gas Production. July 2016. Anchorage, AK: AOGA. .

Archer, A.W., and M.S. Hubbard. 2003. Highest Tides of the World. IN: Chan, M.A. and A.W. Archer, editors. Extreme depositional environments: mega and members in geologic time. Chapter 9. Special Paper – Geological Society of America 370:151–173.

Arrigo, K.R., D.K. Perovich, R.S. Pickart, Z.W. Brown, G.L. van Dijken, K.E. Lowry, M.M. Mills, M.A. Palmer, W.M. Balch, F. Bahr, N.R. Bates, C. Benitez-Nelson, B. Bowler, E. Brownlee, J.K. Ehn, K.E. Frey, R. Garley, S.R. Laney, L. Lubelczyk, J. Mathis, A. Matsuoka, G.B. Mitchell, G.W.K. Moore, E. Ortega-Retuerta, S. Pal, C.M. Polashenski, R.A. Reynolds, B. Schieber, H.M. Sosik, M. Stephens, J.H. Swift. 2012. Massive Phytoplankton Blooms under Arctic Sea Ice. Science. 336(6087):1408.

Arthur, S. M., K. R. Whitten, F. J. Mauer, and D. Cooley. 2003. Modeling the decline of the Porcupine caribou herd, 1989–1998: The importance of survival vs. recruitment. Pages 123–130 [In] 9th North American Caribou Workshop, 23–27 April 2001, Kuujjuaq, Québec, Canada. Rangifer, Special Issue 14.

Atlantic Bluefin Tuna Status Review Team. 2011. Status Review Report of Atlantic bluefin tuna (*Thunnus thynnus*). Report to National Marine Fisheries Service, Northeast Regional Office. March 22, 2011. 104 pp.

Atwood, T. C., B. G. Marcot, D. C. Douglas, S. C. Amstrup, K. D. Rode, G. M. Durner, and J. F. Bromaghin. 2016a. Forecasting the relative influence of environmental and anthropogenic stressors on polar bears. Ecosphere 11(6):e01370. doi:10.1002/ecs2.1370.

Atwood, T. C., E. Peacock, M. A. McKinney, K. Lillie, R. R. Wilson, D. C. Douglas, S. Miller, and P. Terletzky. 2016b. Rapid environmental change drives increased land use by an Arctic marine predator. PLoS One 11(6):e0155932. doi:10.1371/journal.pone.0155932.

Audubon Alaska. 2014. Important Bird Areas by Type. Available online at http://docs.audubon.org/sites/default/files/documents/alaska_ibas_type_20aug2014.pdf. Accessed August 18, 2016.

Audubon Alaska. 2016. Audubon Alaska. 2016. Marine Bird Species Core Area Analysis. Anchorage, AK.

Audubon Society. 2010. Alaska Watchlist 2010: Highlighting Declining and Vulnerable Bird Populations. Audubon Alaska. Anchorage, Alaska. 8 pp.

Austin, D., B. Marks, K. McClain, T. McGuire, B. McMahan, V. Phaneuf, P. Prakash, B. Rogers, C. Ware, and J. Whalen. 2014a. Offshore oil and *Deepwater Horizon*: Social Effects on Gulf Coast Communities, Volume I: Methodology, timeline, context, and communities. Gulf of Mexico OCS Region, New Orleans, LA. OCS Study BOEM 2014-617.

Austin, D., S. Dosemagen, B. Marks, T. McGuire, P. Prakash, and B. Rogers. 2014b. Offshore oil and *Deepwater Horizon*: Social effects on Gulf Coast communities, Volume 2: Key economic sectors, NGOs, and ethnic groups. Gulf of Mexico OCS Region, New Orleans, LA. OCS Study BOEM 2014-618.

Awbrey, F.T. and B.S. Stewart. 1983. Behavioral responses of wild beluga whales (*Delphinapterus leucas*) to noise from oil drilling. J. Acoust. Soc. Am. 74, S54. http://dx.doi.org/10.1121/1.2021025.

Baguley, J.G., P.A. Montagna, C. Cooksey, J.L. Hyland, H.W. Bang, C. Morrison, A. Kamikawa, P. Bennetts, G. Saiyo, E. Parsons, M. Herdener, and M. Ricci. 2015. Community response of deep-sea soft-sediment metazoan meiofauna to the *Deepwater Horizon* blowout and oil spill. Mar Ecol Prog Ser 528:127-140.

Ball, D. R. Clayburn, R. Cordero, B. Edwards, V. Grussing, J. Ledford, R. McConnell, R. Monette, R. Steelquist, E. Thorsgard, J. Townsend. 2015. A Guidance Document for Characterizing Tribal Cultural Landscapes. OCS Study BOEM 2015-047.

Balzano, S., D. Marie, P. Gourvil, and D. Vaulot. 2012. Composition of the summer photosynthetic pico and nanoplankton communities in the Beaufort Sea assessed by T-RFLP and sequences of the 18S rRNA gene from flow cytometry sorted samples. ISME Journal 6: 1480–1498. doi:10.1038/ismej.2011.213.

Barkaszi, M.J., A. Frankle, J. Martin, and W. Poe. 2016. Pressure wave and acoustic properties generated by the explosive removal of offshore structures in the Gulf of Mexico. U.S. Dept. of the Interior, Bureau of Ocean Energy Management, Gulf of Mexico OCS Region, New Orleans, LA. OCS Study BOEM 2016-019. 69 p.

Barnes, D. K. A. 1999. The Influence of Ice on Polar Nearshore Benthos. Journal of the Marine Biological Association of the United Kingdom, 79, 401-407.

Barras, J., Beville, S., Britsch, D., Hartley, S., Hawes, S., Johnston, J., Kemp, P., Kinler, Q., Martucci, A., Porthouse, J., Reed, D., Roy, K., Sapkota, S., and Suhayda, J. 2003. Historical and projected coastal Louisiana land changes: 1978-2050: USGS Open File Report 03-334, 39 p. (Revised January 2004).

Belikov, R.A., and V.M. Bel'kovich. 2003. Underwater vocalization of the beluga whales (*Delphinapterus leucas*) in a reproductive gathering in various behavioral situations. Oceanology (Engl. Transl.) 43, 112–120.

Bell, F.W. 1993. Current and projected tourism demand for saltwater recreational fisheries in Florida (No. 111). Florida Sea Grant College Program, University of Florida.

Bente, P. 2000. Western Alaska Caribou Management, M.V. Hicks, ed. Federal Aid in Wildlife Restoration, Annual Report 1 July to 30 June 2000, Grant W-27-3 Study 3.0. Juneau, AK: State of Alaska, Department of Fish and Game, Div. of Wildlife Conservation.

Bercha Group. 2014. Loss of Well Control Occurrence and Size Estimators for Alaska OCS. Available online at http://www.boem.gov/uploadedFiles/BOEM/BOEM_Newsroom/Library/Publications/BOEM_2014-772.pdf. Accessed October 8, 2015.

Berline, L., Y.H. Spitz, C.J. Ashjian, R.G. Campbell, W. Masolwski, S.E. Moore. 2008. Euphausiid Transport in the Western Arctic Ocean. Marine Ecology Progress Series, 360, 163-178.

Berner, J. 2011. Integrating Health Impact Assessments into the Federal Environmental Impact Process with a Focus on Alaska Native Communities. Prepared by the Alaska Inter-Tribal Council for the Robert Wood Johnson Foundation.

Berrojalbiz, N., S. Lacorte, A. Calbet, E. Saiz, C. Barata, and J. Dachs. 2009. Accumulation and cycling of polycyclic aromatic hydrocarbons in zooplankton. Environ. Sci. Technol. 43:2295-2301.

Beukema, J.J., P.J.C. Honkoop, and R. Dekker. 1998. Recruitment in *Macoma balthica* after mild and cold winters and its possible control by egg production and shrimp predation. Hydrobiologia 375/376: 23−34.

Bianchi, T.S., S.F. DiMarco, J.H. Cowan Jr., R.D. Hetland, P. Chapman, J.W. Day, M.A. Allison. 2010. The Science of Hypoxia in the Northern Gulf of Mexico: A Review. Science of the Total Environment 408:1471-1484.

Bierman Jr., V.J., S.C. Hinz, D. Justić, D. Scavia, J.A. Veil, K. Satterlee III, M.E. Parker, and S. Wilson. 2007. Predicted Impacts from Offshore Produced Water Discharges on Hypoxia in the Gulf of Mexico. 2007 SPE E&P Environmental and Safety Conference, Galveston, Tex., March 5–7.

Biggs, D.C., P.H. Ressler. 2001. Distribution and Abundance of Phytoplankton, Zooplankton, Icthyoplankton, and Micronekton in the Deepwater Gulf of Mexico. Gulf of Mexico Science, 1, 7-29.

Bindoff, N. L. Willebrand, J., et al. 2007. Observations: oceanic climate change and sea level. Pages 385-432 in Solomon, S.D., M. Qin, Z. Chen, M. Marquis, K.B. Averyt, M. Tignor, H.L. Miller, eds. Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge University Press, Cambridge, United Kingdom, and New York, New York. .

Birchenough, SN.R., H. Reiss, S. Degraer, N. Mieszkowska, Á. Borja, L. Buhl-Mortensen, U. Braeckman, J. Craeymeersch, I. De Mesel, F. Kerckhof, I. Kröncke, S. Parra, M. Rabaut, A. Schröder, C. Van Colen, G. Van Hoey, M. Vincx, and K. Wätjen. 2015. Climate change and marine benthos: a review of existing research and future directions in the North Atlantic. WIREs Climate Change, 6: 203–223. doi: 10.1002/wcc.330.

Bjorndal, K. A. 1997. Foraging Ecology and Nutrition of Sea Turtles. In: Lutz, P.L. and J.A. Musick, eds. The Biology of Sea Turtles. Pp. 199-231.

Blackwell S.B., C.S. Nations, T.L. McDonald, A.M. Thode, D. Mathias, K.H. Kim, C. R. Greene Jr., A.M. Macrander. 2015. Effects of Airgun Sounds on Bowhead Whale Calling Rates: Evidence for Two Behavioral Thresholds. PLoS ONE 10(6): e0125720. doi:10.1371/journal.pone.0125720.

Bliss, L.C. 1999. Arctic tundra and polar desert biome. Pages 1-32 in Barbour, M.G. and W.D. Billings, eds, North American Terrestrial Vegetation, Second Edition. New York, NY: Cambridge University Press. 724 pp.

BLM (Bureau of Land Management). 2002. Final Environmental Impact Statement: Renewal of the Federal Grand for the Trans-Alaska Pipeline System Right-of-Way. Anchorage, Alaska.

BLM and MMS (Minerals Management Service). 2003. Northwest National Petroleum Reserve-Alaska, Final Integrated Activity Plan/Environmental Impact Statement. U.S. Department of the Interior, Bureau of Land Management and Minerals Management Service. Anchorage Alaska.

BLM. 2012. National Petroleum Reserve-Alaska (NPR-A) Final Integrated Activity Plan/Environmental Impact Statement. November 2012. 7 Vols. Anchorage, AK: USDOI, BLM.

BLM. 2013. NPR-A Legacy Wells Map. Available online at http://www.blm.gov/ak/st/en/prog/energy/oil_gas/npra/legacywell/maps.html. Accessed July 18, 2016.

BLM. 2016. National Petroleum Reserve in Alaska. Available online at http://www.blm.gov/ak/st/en/prog/energy/oil_gas/npra.html. Accessed August 19, 2016.

BLS (Bureau of Labor Statistics). 2010. Quarterly Census of Employment and Wages: Gulf Coast Leisure and Hospitality Employment and Wages. June 2010. Available online at www.bls.gov/cew/
gulf_coast_leisure_hospitality.htm. Accessed August 20, 2016.

Bluhm B.A. and R. Gradinger. 2008. Regional variability in food availability for Arctic marine mammals. Ecological Applications 18(supplement) S77 -S96.

Blumenthal, J.M., T.J. Austin, J.B. Bothwell, A.C. Broderick, G. Ebanks-Petrie, J.R. Olynik, M.F. Orr, J.L. Solomon, M.J. Witt, and B.J. Godley. 2009. Diving behavior and movements of juvenile hawksbill turtles *Eretmochelys imbricata* on a Caribbean coral reef. Coral Reefs 28(1):55–65.

Boehm, P., D. Turton, A. Raval, D. Caudle, D. French, N. Rabalais, R. Spies, and J. Johnson. 2001. Deepwater program: Literature review, environmental risks of chemical products using in Gulf of Mexico deepwater operations. Volume 1. OCS Study MMS 2001-011. Minerals Management Service, Gulf of Mexico OCS Region, New Orleans. 326 pp.

Boehm, P.D. 2001. Sediment Quality in Depositional Areas of Shelikof Strait and Outermost Cook Inlet. OCS Study, MMS 2000-024. Anchorage, AK: USDOI, MMS, Alaska OCS Region.

Boehm, P.D., L.L. Cook and K.J. Murray. 2011. Aromatic hydrocarbon concentrations in seawater: *Deepwater Horizon* Oil Spill. 2011 International Oil Spill Conference. #2011-371. 13 pp.

BOEM (Bureau of Ocean Energy Management). 2011a. Chukchi Sea Planning Area Oil and Gas Lease Sale 193 in the Chukchi Sea, Alaska. Final Supplemental Environmental Impact Statement. Volume I. Chapters I – VI and Appendices A, B, C, D. OCS EIS/EA BOEMRE 2011-04. 590 pp.

BOEM. 2011b. MAG-PLAN Alaska Update. U.S. Department of the Interior, Bureau of Ocean Energy Management, Alaska OCS Region, Anchorage, AK. OCS Study BOEM 2011-059.

BOEM. 2012a. Gulf of Mexico OCS Oil and Gas Lease Sales: 2012–2017; Western Planning Area Lease Sales 229, 233, 238, 246, and 248; Central Planning Area Lease Sales 227, 231, 235, 241, and 247 – Final Environmental Impact Statement. U.S. Department of the Interior, Bureau of Ocean Energy Management, New Orleans, LA. OCS EIS/EA BOEM 2012-019. 3 vols.

BOEM. 2012b. Outer Continental Shelf Oil and Gas Leasing Program: 2012–2017. Final Programmatic Environmental Impact Statement. Vol. 1-4.OCS EIS/EA, BOEM 2012-030.

BOEM. 2012c. MAG-PLAN 2012: Economic Impact Model for the Gulf of Mexico—Updated and Revised Data. U.S. Dept. of the Interior, Bureau of Ocean Energy Management, Gulf of Mexico OCS Region, New Orleans, LA. OCS Study BOEM 2012-102.

BOEM. 2013. Gulf of Mexico OCS Oil and Gas Lease Sales: 2014 and 2016. Eastern Planning Area Lease Sales 225 and 226. Final Environmental Impact Statement. U.S. Department of the Interior, Bureau of Ocean Energy Management, Gulf of Mexico OCS Region, New Orleans, LA. OCS EIS/EA BOEM 2013-200.

BOEM. 2014b. Economic Inventory of Environmental and Social Resources Potentially Impacted by a Catastrophic Discharge Event Within OCS Regions. OCS Study BOEM 2014-669. 184 pp.

BOEM. 2015a. 2017–2022 OCS Oil and Gas Leasing Draft Proposed Program. January 2015.

BOEM. 2015b. Chukchi Sea Planning Area Oil and Gas Lease Sale 193 in the Chukchi Sea, Alaska. Final Second Supplemental Environmental Impact Statement. Volumes 1 and 2. U.S. Department of the Interior, Bureau of Ocean Energy Management, Alaska OCS Region, Anchorage, AK.

BOEM. 2015c. Shell Revised Exploration Plan, Environmental Assessment. U.S. Department of the Interior, Bureau of Ocean Energy Management, Alaska OCS Region, Anchorage, AK.

BOEM. 2015d. Gulf of Mexico OCS Oil and Gas Lease Sales: 2016 and 2017. Central Planning Area Lease Sales 241 and 247. Eastern Planning Area Lease Sale 226. Final Environmental Impact Statement. U.S. Department of the Interior, Bureau of Ocean Energy Management, Gulf of Mexico OCS Region, New Orleans, Louisiana. OCS EIS/EA BOEM 2015-033.

BOEM. 2015e. Gulf of Mexico OCS Oil and Gas Lease Sale: 2016. Western Planning Area Lease Sale 248. Draft Supplemental Environmental Impact Statement. U.S. Department of the Interior, Bureau of Ocean Energy Management, Gulf of Mexico OCS Region, New Orleans, LA. OCS EIS/EA BOEM 2015-032.

BOEM. 2016a. 2017-2022 Outer Continental Shelf Oil and Gas Leasing Proposed Program. U.S. Department of the Interior, Bureau of Ocean Energy Management, Sterling, Virginia. March 2016.

BOEM. 2016b. Economic Analysis Methodology for the OCS Oil and Gas Leasing Program for 2017-2022. U.S. Department of the Interior, Bureau of Ocean Energy Management, Sterling, Virginia.

BOEM. 2016c. 2017–2022 Outer Continental Shelf Oil and Gas Leasing Proposed Final Program, U.S. Department of the Interior, Bureau of Ocean Energy Management, Sterling, Virginia. November 2016.

BOEM. 2016d. Essential Fish Habitat Assessment for the Gulf of Mexico. U.S. Department of the Interior, Bureau of Ocean Energy Management, Gulf of Mexico OCS Region, New Orleans, Louisiana. OCS Report BOEM 2016-16.

BOEM. 2016e. Gulf of Mexico OCS Oil and Gas Lease Sales: 2017–2022, Gulf of Mexico Lease Sales 249, 250, 251, 252, 253, 254, 256, 257, 259, and 261. Draft Environmental Impact Statement. Volume 1. OCS EIS/EA BOEM 2016-018.

BOEM. 2016f. A Native Whaler's View. Available online at http://www.boem.gov/About-BOEM/Public-Engagement/Tribal-Communities/Alaska/A-Native-Whalers-View.aspx. Accessed September 1, 2016.

BOEM. 2016g. Gulf of Mexico OCS Oil and Gas Lease Sales: 2017–2022, Gulf of Mexico Lease Sales 249, 250, 251, 252, 253, 254, 256, 257, 259, and 261. Appendix to the Draft Environmental Impact Statement – Technical Support Document 2012 WRF Model Performance Evaluation. Manuscript in preparation.

BOEM. 2016h. Gulf of Mexico OCS Oil and Gas Lease Sales: 2017–2022, Gulf of Mexico Lease Sales 249, 250, 251, 252, 253, 254, 256, 257, 259, and 261. Appendix to the Draft Environmental Impact Statement – Technical Support Document: Development of Emission Inventories to Support Cumulative and Visibility Impacts Analyses. Manuscript in preparation.

BOEM. 2016i. Gulf of Mexico OCS Oil and Gas Lease Sales: 2017–2022, Gulf of Mexico Lease Sales 249, 250, 251, 252, 253, 254, 256, 257, 259, and 261. Appendix to the Draft Environmental Impact Statement – Draft Technical Support Document: Cumulative and Visibility Impacts Analyses. Manuscript in preparation.

BOEM. 2016j. Alaska OCS Lease Sale 244: 2016. Draft Environmental Impact Statement. U.S. Department of the Interior, Bureau of Ocean Energy Management, Alaska OCS Region, Anchorage, AK. OCS EIS/EA BOEM 2016-004.

BOEM. 2016k. MAG-PLAN Alaska Update. BOEM Report. Manuscript in preparation.

BOEM. 2014a. Atlantic OCS Proposed Geological and Geophysical Activities. Mid-Atlantic and South Atlantic Planning Areas. Final Programmatic Environmental Impact Statement. Gulf of Mexico Region, New Orleans, LA. OCS EIS/EA BOEM 2014-001.

BOEMRE (Bureau of Ocean Energy Management, Regulation, and Enforcement). 2011. Chukchi Sea Planning Area, Oil and Gas Lease Sale 193 in the Chukchi Sea, Alaska, Final Supplemental Environmental Impact Statement, OCS EIS/EA, BOEMRE 2011-041, Aug.

Boesch, D.F., M.N. Josselyn, A.J. Mehta, J.T. Morris, W.K. Nuttle, C.A. Simenstad and D.J.P. Swift. 1994. Scientific Assessment of Coastal Wetland Loss, Restoration and Management in Louisiana. Journal of Coastal Research, Special Issue No. 20. pp. i-v, 1-103.

Bogoslovskaya, L., L. Votrogov, and T. Semenova. 1981. Feeding habits of the gray whale off Chukotka. SC/32/PS20. Report of the International Whaling Commission 31: 507-510.

Brierley, A.S. and M.J. Kingsford. 2009. Impacts of Climate Change on Marine Organisms and Ecosystems. Current Biology, 19, Special Issue R603.

Brightman, R.A. 2004. Chitimacha. In: William Sturtevant (ed.). *Handbook of North American Indians, Volume 14*: Southeast. Smithsonian Institution Press. Washington DC. p. 642.

Britton, J.C. and B. Morton. 1989. Shore Ecology of the Gulf of Mexico. Austin, Texas: University of Texas Press. 387p.

Brooks, J.M., C. Fisher, H. Roberts, E. Cordes, I. Baums, B. Bernard, R. Church, P. Etnoyer, C. German, E. Goehring, I. McDonald, Harry Roberts, T. Shank, D. Warren, S. Welsh, G. Wolff, and D. Weaver. 2016. Exploration and research of northern Gulf of Mexico deepwater natural and artificial hard-bottom habitats with emphasis on coral communities: Reefs, rigs, and wrecks "*Lophelia* II" Final report. U.S. Dept. of the Interior, Bureau of Ocean Energy Management, Gulf of Mexico OCS Region, New Orleans, LA. OCS Study BOEM 2016-021. 628 p.

Brower, Harry Jr. and Hepa Taqulik. 1998. Subsistence Hunting Activities and the Inupiat Eskimo, Cultural Survival Quarterly. Available online at https://www.culturalsurvival.org/publications/cultural-survival-quarterly/united-states/subsistence-hunting-activities-and-inupiat-es. Accessed August 24, 2016.

Brown, C.L., A.R. Hardy, J.R. Barber, K.M. Fristrup, K.R. Crooks, and L.M. Angeloni. 2012. The Effect of Human Activities and their Associated Noise on Ungulate Behavior. PLoS ONE 7(7): e40505.

Brown-Peterson, N.J., M. Krasnec, R. Takeshita, C.N. Ryan, K.J. Griffitt, C. Lay, G.D. Mayer, K.M. Bayha, W.E. Hawkins, I. Lipton, J. Morris, and R.J. Griffitt. 2015. A multiple endpoint analysis of the effects of chronic exposure to sediment contaminated with *Deepwater Horizon* oil on juvenile Southern flounder and their associated microbiomes. Aquatic Toxicology 165:197-209.

Brueggeman, J. 2009. Marine mammal surveys at the Klondike and Burger survey areas in the Chukchi Sea during the 2008 open water season. Unpublished report prepared for ConocoPhillips and Shell Exploration and Production Company, Anchorage, AK, by Canyon Creek Consulting LLC, Seattle, WA. 46 pp.

Brueggeman, J.J., D.P. Volsen, R.A. Grotenfendt, G.A. Green, J.J. Burns, and D.K. Ljungblad. 1991. Final Report Shell Western E&P Inc. 1990 walrus monitoring program: The Popcorn, Burger, and Crackerjack Prospects in the Chukchi Sea. Prepared by Ebasco Environmental for Shell Western E&P Inc. February 1991.

BSEE (Bureau of Safety and Environmental Enforcement). 2013. Rigs-to-Reefs Interim Policy. Available online at https://www.bsee.gov/sites/bsee.gov/files/bsee-interim-document/fact-sheet/rigs-to-reefs-ipd.pdf. Accessed August 22, 2016.

BSEE. 2015. Annual Report. Available online at https://www.bsee.gov/sites/bsee_prod.opengov.ibmcloud.com/files/bsee_final_annual_report_2015.pdf. Accessed August 4, 2016.

BSEE. 2016. ECD Rigs to Reefs. Available online at https://www.bsee.gov/what-we-do/environmental-focuses/rigs-to-reefs. Accessed September 1, 2016.

Bugoni, L., L. Krause, and M.V. Petry. 2001. Marine Debris and human impacts on sea turtles in Southern Brazil. Marine Pollution Bulletin 42(12): 1330-1334.

Buist, I., R. Belore, D. Dickins, D. Hackenberg, A. Guarino and Z. Wang. 2008. Empirical Weathering Properties of Oil in Ice and Snow. Anchorage, Alaska. OCS Study MMS 2008-033. 154 pp.

Bunn, S.E. and A.H. Arthington. 2002. Basic Principles and Ecological Consequences of Altered Flow Regimes for Aquatic Biodiversity. Environmental Management, 30, No. 4, 492-507.

Burgess RM. Arctic fox. *The natural history of an arctic oil field: development and the biota*. Academic Press, San Diego, California, USA. 2000:159-78.

Burgess, R.M., R. Rose, P.W. Banyas, and B.E. Lawhead. 1993. Arctic fox studies in the Prudhoe Bay Unit and adjacent undeveloped areas, 1992. Northern Alaska Research Studies. Anchorage, AK: BPXA, 16 pp.

Butler, R.W. and W. Taylor. 2005. A Review of Climate Change Impacts on Birds. USDA Forest Service Gen. Tech. Rep. PSW-GTR-191.

Byrnes, M.R., J.D. Rosati, S.F. Griffee, and J.L. Berlinghoff. 2013. Historical sediment transport pathways and quantities for determining an operational sediment budget: Mississippi Sound barrier islands. Journal of Coastal Research 63: 166-183.

Cai, W.J., X. Hu, W.J. Huang, M.C. Murrell, J.C. Lehrter, S.E. Lohrenz, W.C. Chou, W. Zhai, J.T. Hollibaugh, Y. Wang. 2011. Acidification of subsurface coastal waters enhanced by eutrophication. Nature Geosciences 4: 766e770.

Caillouet, Jr., C.W., D.J. Shaver, W.G. Teas, J.M Nance, D.B. Revera, and A.C. Cannon. 1996. Relationship between sea turtle stranding rates and shrimp fishing intensity in the northwestern Gulf of Mexico: 1086-1989 versus 1990-1993. Fishery Bulletin 94:237-249.

Calef, G.W., DeBock, E.A. and Lortie, G.M. 1976. The reaction of barren-ground caribou to aircraft. Arctic, 29(4): 201-212.

Camacho, M., L.D. Boada, J. Oros, P. Calabuig, M. Zumbado, and O. Luzardo. 2012. Comparative study of polycyclic aromatic hydrocarbons (PAHs) in plasma of Eastern Atlantic juvenile and adult nesting loggerhead sea turtles (*Caretta caretta*). Marine Pollution Bulletin 64: 1974-1980.

Cameron, R.D. and K.R. Whitten. 1979. Seasonal movements and sexual segregation of caribou determined by aerial survey. Journal of Wildlife Management 43(3):626-633.

Cameron, R.D., W.T. Smith, R.G. White, and B. Griffith. 2005. Central Arctic caribou and petroleum development: distributional, nutritional, and reproductive implications. Arctic 2005: 1-9.

Camilli, R., C.M. Reddy, D.R. Yoerger, B.A.S. Van Mooy, M.V. Jakuba, J.C. Kinsey, C.P. McIntyre, S.P. Sylva, and J.V. Maloney. 2010. Tracking Hydrocarbon Plume Transport and Biodegradation at *Deepwater Horizon*. Science 330:201–204.

Campisi, J. 2004. Houma. In *The Handbook of North American Indians.* Vol. 14, Southeast. Raymond D. Fogelson, ed. Washington, DC: Smithsonian Institution Press. pp. 632-641.

Cape International, Inc. 2012. Cook Inlet Vessel Traffic Study, Report to Cook Inlet Risk Assessment Advisory Panel. Available online at http://www.cookinletriskassessment.com/documents/120206CIVTSvFINAL.pdf. Accessed October 5, 2016.

Cardona, Y., A. Bracco, T.A. Villareal, A. Subramaniam, S.C. Weber, J.P. Montoya. 2016. Highly Variable Nutrient Concentrations in the Northern Gulf of Mexico. Deep Sea Research II 129: 20-30.

Carr, R.S., D.C. Chapman, B.J. Presley, J.M. Biedenbach, L. Robertson, P. Boothe, R. Kilada, T. Wade, and P. Montagna. 1996. Sediment porewater toxicity assessment studies in the vicinity of offshore oil and gas production platforms in the Gulf of Mexico. Canadian Journal of Fisheries and Aquatic Science 53:2618-2682.

Carroll, G. 1991. Game management unit 26a Western North Slope. In: Brown bear, S.M. Abbott, ed. Federal Aid Wildlife Restoration Annual Performance Report of Survey-Inventory Activities 1 July 1990- 30 June 1991 XXII, Part V Project W-23-4, Study 4.0. Juneau, AK: State of Alaska, Department of Fish and Game, Div. of Wildlife Conservation, 271 pp.

Carroll, G. 2005. Unit 26A brown bear management report. In: Brown bear management report of Survey and inventory A 1 July 2002-30 June 2004, C. Brown, ed. Juneau, AK: State of Alaska, Department of Fish and Game, pp. 310-325.

Carter, G.A., K.L. Lucas, P.D. Biber, G.A. Criss, and G.A., Blossom. 2011. Historical changes in seagrass coverage on the Mississippi barrier islands, northern Gulf of Mexico, determined from vertical aerial imagery (1940-2007). Geocarto International. December 2011, 26(8):663-673.

Casazza, T.L. and S.W. Ross. 2008. Fishes associated with pelagic *Sargassum* and open water lacking *Sargassum* in the Gulf Stream off North Carolina. Fishery Bulletin 106: 348–363.

CEQ (Council on Environmental Quality). 1997a. Considering Cumulative Effects under the National Environmental Policy Act. January 1997.

CEQ. 1997b. Environmental Justice: Guidance under the National Environmental Policy Act. Council on Environmental Quality. Executive Office of the President. Washington DC. 34 pp.

CEQ. 2014. Final Guidance for Effective Use of Programmatic NEPA Review. Council on Environmental Quality. Executive Office of the President. Washington DC.

Chanton, J., T. Zhao, B.E. Rosenheim, S. Joye, S. Bosman, and C. Brunner. 2015. Using Natural Abundance Radiocarbon to Trace the Flux of Petrocarbon to the Seafloor Following the *Deepwater Horizon* Oil Spill. Environmental Science and Technology 49(2): 847–854.

Chapman, P.M., E.A. Power, R.N. Dexter, and H.B. Andersen. 1991. Evaluation of effects associated with and oil platform, using the sediment quality triad. Environmental Toxicology and Chemistry 10:407-424.

Chesemore, D.L. 1967. Ecology of the Arctic fox in Northern and Western Alaska. Fairbanks, AK: University of Alaska, 148 pp.

Cheung, W.W., Lam, V.W., Sarmiento, J.L., Kearney, K., Watson, R., Pauly, D., and Pauly, D. 2010. Large-scale redistribution of maximum fisheries catch potential in the global ocean under climate change. Global Change Biology 16: 24–35.

Citta, J.J., L.T. Quakenbush, S.R. Okkonen, M.L. Druckenmiller, W. Maslowski, J. ClementKinney, J.C. George, H. Brower, R.J. Small, C.J. Ashjian, L.A. Harwood, and M.P. Heide-Jørgensen. 2015. Ecological characteristics of core-use areas used by Bering-Chukchi Beaufort (BDB) bowhead whales, 2006-2012. Progress in Oceanography 136: 201-222.

Clark, W.W. 1991. Recent studies of temporary threshold shift (TTS) and permanent threshold shift (PTS) in animals. Journal of the Acoustical Society of America 90(1):155-163.

Clarke, J.T., M.C. Ferguson, C. Curtice, and J. Harrison. 2015b. Biologically important areas for cetaceans within U.S. waters – Arctic Region. Aquatic Mammals 41(1): 94-103. DOI:10.1578/AM.41.1.2015.94.

Clarke, Janet T., Amelia A. Brower, Megan C. Ferguson, Amy S. Kennedy, and Amy L. Willoughby. 2015a. Distribution and Relative Abundance of Marine Mammals in the Eastern Chukchi and Western Beaufort Seas, 2014. Annual Report. OCS Study BOEM 2015-040.

Codispoti, L.A., C. Flagg, V. Kelly, and J.H. Swift. 2005. Hydrographic conditions during the 2002 SBI process experiments. Deep Sea Research Part II: Topical Studies in Oceanography 52: 3199-3226.

Colborn, T., F.S. vom Saal, and A.M. Soto. 1993. Developmental effects of endocrine-disrupting chemicals in wildlife and humans. Environmental Health Perspectives 101:378-384.

Collard, S.B. 1990. Leatherback turtles feeding near a watermass boundary in the eastern Gulf of Mexico. Marine Turtle Newsletter 50: 12-14.

Conant, T.A., P.H. Dutton, T. Eguchi, S.P. Epperly, C.C. Fahy, M.H. Godfrey, S.L. MacPherson, E.E. Possardt, B.A. Schroeder, J.A. Seminoff, M.L. Snover, C.M. Upite, and B.E. Witherington. 2009. Loggerhead sea turtle (*Caretta caretta*) 2009 status review under the U.S. Endangered Species Act. Report of the loggerhead Biological Review team to the U.S. Department of Commerce National Marine Fisheries Service, August 2009. 222 pp.

Condrey, R., P. Kemp, J. Visser, J. Gosselink, D. Lindstedt, E. Melancon Jr., G. Peterson, and B. Thompson. 1996. Status, trends, and probable causes of change in living resources in the Barataria-Terrebonne Estuarine System. Thibodeaux, LA: Barataria-Terrebonne National Estuary Program. 506 pp.

Conlan, K.E. and R.G. Kvitek. 2005. Recolonization of soft-sediment ice scours on an exposed Arctic coast. Marine Ecology Progress Series. 286:21-42.

Cosentino-Manning N., Kenworthy J., Handley L., Wild M., Rouhani S., Spell R. 2015. Submerged aquatic vegetation exposure to *Deepwater Horizon* spill. DWH SAV NRDA Technical Working Group Report. Available online at https://pub-dwhdatadiver.orr.noaa.gov/dwh-ar-documents/919/DWH-AR0270744.pdf. Accessed August 13, 2016.

Coston-Clements, L., L.R. Settle, D.E. Hoss and F.A. Cross. 1991. Utilization of the *Sargassum* habitat by marine invertebrates and vertebrates - a review. NOAA Technical Memorandum NMFS-SEFSC-296. 32 pp.

Couvillion, B.R., J.A. Barras, G.D. Steyer, W. Sleavin, M. Fischer, H. Beck, N. Trahan, B. Griffin, and D. Heckman. 2011. Land area change in coastal Louisiana from 1932 to 2010: U.S. Geological Survey Scientific Investigations Map 3164, scale 1:265,000, 12 p. pamphlet.

CPRA (Coastal Protection and Restoration Authority). 2014. Barrier island status report: Fiscal year 2015 annual plan.

Cronin, Matthew A., Heather A. Whitlaw, and Warren B. Ballard. Northern Alaska Oil Fields and Caribou. Wildlife Society Bulletin 28.4 (2000): 919-22.

Crystal Cruises. 2016. The Northwest Passage. Anchorage to New York on Crystal Serenity: Itinerary. Available online at http://www.crystalcruises.com/northwest-passage-cruise/northwest-passage--6319. Accessed June 29, 2016.

CSA. 2004. Gulf of Mexico Comprehensive Synthetic Based Muds Monitoring Program, Technical Report, Vol. 1, prepared for the Synthetic Based Muds Research Group.

CSA. 2006. Effects of Oil and Gas Exploration and Development at Selected Continental Slope Sites in the Gulf of Mexico. Volume II: Technical Report. U.S. Department of the Interior, Minerals Management Service, Gulf of Mexico OCS Region, New Orleans, LA. OCS Study MMS 2006-045. 636 pp.

CSLC (California State Lands Commission). 2013. Mitigated Negative Declaration. Low Energy Offshore Geophysical Permit Program Update. Final September 2013. Prepared for the California State Lands Commission, Sacramento, CA. 443 pp.

CSLC and MMS (Minerals Management Service, Pacific Outer Continental Shelf Region). 1999. High energy seismic survey review process and interim operational guidelines for marine surveys offshore Southern California. Camarillo, California: High Energy Seismic Survey Team.

D'Andrea, M. and R.G. Kesava. 2014. Crude Oil Spill Exposure and Human Health Risks. Journal of Occupational & Environmental Medicine. Vol. 56(10) pp. 1029-1041.

Dahl, T.E. and S.M. Stedman. 2013. Status and trends of wetlands in the coastal watersheds of the conterminous United States 2004 to 2009. (46 p.).

Darnis, G., D.G. Barber, and L. Fortier. 2008. Sea ice and the onshore–offshore gradient in pre-winter zooplankton assemblages in southeastern Beaufort Sea. Journal of Marine Systems 74(3):994-1011.

Dau, J. 2005. Units 21D, 22A, 22B, 22C, 22D, 22E, 23, 24, and 26A Caribou management report. In: Caribou management report of survey and inventory activities 1 July 2002-30 June 2004, C. Brown, ed. Project 3.0. Juneau, AK: State of Alaska, Department of Fish and Game, pp. 177-218.

Davis, R.W. and G.S. Fargion, eds. 1996. Distribution and abundance of cetaceans in the north-central and western Gulf of Mexico: Final Report. Volume II: Technical Report. OCS Study MMS 96-0027. Prepared by the Texas Institute of Oceanography and the National Marine Fisheries Service. U.S. Department of the Interior, Minerals Management Service, Gulf of Mexico OCS Region, New Orleans, LA. 357 pp.

Dawes, C.J., R.C. Phillips, and G. Morrison. 2004. Seagrass Communities of the Gulf Coast of Florida: Status and Ecology. Florida Fish and Wildlife Conservation Commission Fish and Wildlife Research Institute and the Tampa Bay Estuary Program, St. Petersburg, FL. iv + 74 pp.

Day, J.W., Jr., Britsch L. D., S.R. Hawes, G.P. Shaffer, D.J. Reed, D. Cahoon. 2000. Pattern and process of land loss in the Mississippi Delta: a spatial and temporal analysis of wetland habitat change. Estuaries. 23: 425-438.

Day, J.W. Jr., G.P. Shaffer, D.J. Reed, D.R. Cahoon, L.D. Britsch and S.R. Hawes. 2001. Patterns and Processes of Wetland Loss in Coastal Louisiana are Complex: A Reply to Turner 2001, Estimating the Indirect Effects of Hydrologic Change on Wetland Loss: If the Earth Is Curved, Then How Would We Know It? Estuaries, Vol. 24, No. 4 (Aug., 2001), pp. 647-651.

DeLeo, D.M., D. Ruiz-Ramos, I.B. Baums and E.E. Cordes. 2015. Response of deep-water corals to oil and chemical dispersant exposure. Deep Sea Research Part II: Topical Studies in Oceanography 129:137-147.

DeNavas-Walt, Carmen, and Bernadette D. Proctor. 2015. Income and Poverty in the United States: 2014: Current Population Reports. U.S. Census Bureau, Sept. 2015.

DeVoe, M.R and C.E. Hodges. 2002. Responsible Marine Aquaculture. CABI Publishing, Wallingford, Oxon, United Kingdom. Doi: 10.1079/9780851996042.0021.

Diercks, A.-R., R. C. Highsmith, V. L. Asper, D. Joung, Z. Zhou, L. Guo, A. M. Shiller, S. B. Joye, A. P. Teske, N. Guinasso, T. L. Wade and S. E. Lohrenz. 2010. Characterization of subsurface polycyclic aromatic hydrocarbons at the *Deepwater Horizon* site. Geophysical Research Letters 37(20): L20602.

DiMarco, S.F., M.K. Howard, W.D. Nowlin, Jr., and R.O. Reid. 2004. Subsurface, High-Speed Current Jets in the Deepwater Region of the Gulf of Mexico, Final Report. OCS Study 2004-022, Minerals Management Service, Gulf of Mexico OCS Region, New Orleans, LA.

Dismukes, D.E. 2010. Fact book: Offshore oil and gas industry support sectors. U.S. Dept. of the Interior, Bureau of Ocean Energy Management, Regulation and Enforcement, Gulf of Mexico OCS Region, New Orleans, LA. OCS Study BOEMRE 2010-042.

Dismukes, D.E. 2011. OCS-Related Infrastructure Fact Book, Volume I: Post-Hurricane Impact Assessment. Louisiana State University, Center for Energy Studies. OCS Study, BOEM-2011-043. Baton Rouge, LA: USDOI, BOEM Gulf of Mexico OCS Region.

Dismukes, D.E. 2014. Onshore oil and gas infrastructure to support development in the Mid-Atlantic OCS Region. Louisiana State University, Center for Energy Studies. OCS Study, BOEM-2014-657. Baton Rouge, LA: USDOI, BOEM Gulf of Mexico OCS Region.

Ditty, J. G., G. G. Zieske, and R. F. Shaw. 1988. Seasonality and depth distribution of larval fishes in the northern Gulf of Mexico above latitude 26°00′N. Fisheries Bulletin 86:811–823.

Do, M.P., P.L. Hutchinson, K.V. Mai, M.J. Vanlandingham. 2009. Disparities in health care among Vietnamese New Orleanians and the impacts of Hurricane Katrina. Research in the Sociology of Health Care 27:301-319.

Doney, S. C., V. J. Fabry, R. A. Feely and J. A. Kleypas. 2009. Ocean Acidification: The Other CO_2 Problem. Annual Review of Marine Science 1(1): 169-192.

Doney, S., A.A. Rosenberg, M. Alexander, F. Chavez, C.D. Harvell, G. Hofmann, M. Orbach, M. Ruckelshaus. 2014. Oceans and marine resources. Climate Change Impacts in the United States: The Third National Climate Assessment. U.S. Global Change Research Program: 557-578.

Dooley, J.K. 1972. Fishes associated with the pelagic *Sargassum* complex, with a discussion of the *Sargassum* community. Contributions in Marine Science 16:1-32.

Doroff, A. and K. Holderied. 2015. Long-term monitoring of oceanographic conditions in Cook Inlet/Kachemak Bay to understand recovery and restoration of injured near-shore species. Attachment C, EVOSTC Annual Project Report Form 11 p.

Drew, G. F. and J. Piatt. 2013. North Pacific Pelagic Seabird Database (NPPSD) v2. US Geological Survey Alaska Science Center & US Fish and Wildlife Service, Anchorage, AK. Available online at http://alaska.usgs.gov/science/biology/nppsd/index.php. Accessed August 13, 2016.

Driskell, W.B. and J.R. Payne. 2011. Preliminary Data Report for LTEMP 2008-2010. 4pp.

Drozdowski, A., S. Nudds, C.G. Hannah, H. Niu, I. Peterson, W. Perrie. 2011. Review of Oil Spill Trajectory Modeling in the Presence of Ice. Can. Tech. Rep. Hydrog. Ocean Sci. 274: vi + 84 pp.

Dunn, E.H. 1993. Bird Mortality from Striking Residential Windows in Winter. Journal of Field Ornithology. 64:302–309.

Dunton, K.H., and S.V. Schonberg. 2000. The benthic faunal assemblage of the boulder patch kelp community. Pages 372-397 in Johnson S.R. and J.C. Truett, eds. *The natural history of an Arctic oil field*. Academic Press, San Diego.

Dunton, K.H., J.L., Goodall, S.V. Schonberg, J.M. Grebmeier, and D.R. Maidment. 2005. Multi-decadal synthesis of benthic–pelagic coupling in the western arctic: role of cross-shelf advective processes. Deep Sea Research Part II Topical Studies in Oceanography 52(24): 3462-3477.

Dunton, K.H., J.M. Grebmeier, and J. H. Trefry. 2014. The benthic ecosystem of the northeastern Chukchi Sea: an overview of its unique biogeochemistry and biological characteristics. Deep-Sea Research II 102: 1-8.

Dunton, K.H., S.V. Schonberg, and D.M. Schell. 1984. Biological reconnaissance of Boulder Island Shoal in western Camden Bay, Beaufort Sea, Alaska. MMS Completion Report 183-26.

Dunton, K.H., T. Weingartner, and E.C. Carmack. 2006. The nearshore western Beaufort Sea ecosystem: circulation and importance of terrestrial carbon in arctic coastal food webs. Progress in Oceanography 71.2: 362-378.

Durner, G. M., D. C. Douglas, R. M. Nielson, S. C. Amstrup, T. L. McDonald, I. Stirling, M. Mauritzen, E. W. Born, O. Wiig, E. DeWeaver, M. C. Serreze, S. E. Belikov, M. M. Holland, J. Maslanik, J. Aars, D. C. Bailey, and A. E. Derocher. 2009. Predicting 21st century polar bear habitat distribution from global climate models. Ecological Monographs 79:107-120.

Durner, G.M., Fischbach, A.S., Amstrup, S.C., and Douglas, D.C. 2010. Catalogue of polar bear (*Ursus maritimus*) maternal den locations in the Beaufort Sea and neighboring regions, Alaska, 1910–2010: U.S. Geological Survey Data Series 568, 14 p.

DWHNRT (Deepwater Horizon Natural Resource Trustees). 2016. *Deepwater Horizon* oil spill: Final Programmatic Damage Assessment and Restoration Plan and Final Programmatic Environmental Impact Statement.

Eastern Research Group, Inc. 2014. Assessing the Impacts of the *Deepwater Horizon* Oil Spill on Tourism in the Gulf of Mexico Region. Gulf of Mexico OCS Region, New Orleans, LA. OCS Study BOEM 2014-661. 188 pp.

Eberhardt, L.E., W.C. Hanson, J.L. Bengtson, R.A. Garrott, and E.E. Hanson. 1982. Arctic fox home range characteristics in an oil-development area. Journal Wildlife Management 461:183-190.

Eccleston, C.H. 2011. Environmental Impact Assessment. A Guide to Best Professional Practices. Boca Raton, FL: CRC Press, 268 pp.

Eggleton, J.D., R. Smith, H. Reiss, E. Rachor, E. Vanden Berghe and H.L. Rees. 2007. Species distributions and changes (1986-2000). ICES Cooperative Research Report 288: 91-108.

Epperly, S.P. and W.G. Teas. 2002. Turtle excluder devices—Are the escape openings large enough? Fishery Bulletin 100(3): 466-474.

Erickson, W.P., G.D. Johnson, D.P. Young. 2005. A summary and comparison of bird mortality from anthropogenic causes with an emphasis on collisions. Pages 1029-1042 in Ralph, C.J, T.D. Rich, eds. Bird Conservation Implementation and Integration in the Americas: Proceedings of the Third International Partners in Flight Conference. 2002 March 20-24; Asilomar, California, Volume 2 Gen. Tech. Rep. PSW-GTR-191. Albany, CA: U.S. Dept. of Agriculture, Forest Service, Pacific Southwest Research Station.

Ershova, E.A., R.R. Hopcroft, K.N. Kosobokova, K. Matsuno, R.J. Nelson, A. Yamaguchi, L.B. Eisner. 2015. Long-term Changes in Summer Zooplankton Communities of the Western Chukchi Sea, 1945-2012. Oceanography 28(3): 100-115.

Executive Office of the President. 2013. The President's Climate Action Plan (June 2013). Available online at https://www.whitehouse.gov/sites/default/files/image/president27sclimateactionplan.pdf. Accessed August 18, 2016.

FAA (Federal Aviation Administration). 2004 Visual Flight Rules (VFR) Flight Near Noise-Sensitive Areas. AC No:91-36D. U.S. Department of Transportation. Federal Aviation Administration.

Fabry, V.J., B.A. Seibel, R.A. Feely, J.C. Orr. 2008. Impacts of Ocean Acidification on Marine Fauna and Ecosystem Processes. International Council for the Exploration of the Sea.

Fall, J.A. 2014. Subsistence in Alaska: A Year 2012 Update. Prepared for the Alaska Department of Fish and Game, Division of Subsistence.

Fall, J.A. 1992. An Update on Subsistence Uses in Alaska Native Villages Following the Exxon Valdez Oil Spill. Alaska Department of Fish and Game, Division of Subsistence, Fairbanks, Alaska. Special Publication No. SP1992-001.

Fall, J.A., and C.J. Utermohle. 1999. Subsistence Harvests and Uses in Eight Communities Ten Years after the Exxon Valdez Oil Spill, Technical Paper No. 252, ADF&G, Division of Subsistence, Juneau, Alaska.

Fall, J.A., L.J. Field, T.S. Nighswander, N. Peacock, and U. Varansi, eds. 1999. Overview of Lessons Learned from the Exxon Valdez Oil Spill: A 10-Year Retrospective. In: *Evaluating and Communicating Subsistence Seafood Safety in a Cross-Cultural Context*, SETAC Press, Pensacola, Fla.

Fall, J.A., N.M. Braem, C.L. Brown, S.S. Evans, L. Hutchinson-Scarbrough, H. Ikuta, B. Jones, R. La Vine, T. Lemons, M.A. Marchioni, E. Mikow, J.T. Ream, and L.A. Sill. 2014. Alaska Subsistence and Personal Use Salmon Fisheries 2012 Annual Report. Technical Paper No. 406. Prepared for the Alaska Department of Fish and Game, Division of Subsistence.

Fall, J.A., R.T. Stanek, B. Davis, L. Williams, and R. Walker. 2004. Cook Inlet Customary and Traditional Subsistence Fisheries Assessment. Technical Paper 285 prepared for Alaska Department of Fish and Game, Division of Subsistence, Juneau, AK. .

Fancy, S.G. 1983. Movements and activity budgets of caribou near oil drilling sites in the Sagavanirktok River floodplain, Alaska. Arctic, pp.193-197.

Fay, F.H. and E.H. Follman. 1982. The Arctic fox (*Alopex lagopus*) species account. No. 3917. Juneau, AK: USDOC, NOAA, OCSEAP, 27 pp.

FDEP (Florida Department of Environmental Protection). 2010. Salt marshes. Available online at http://www.dep.state.fl.us/coastal/habitats/saltmarshes.htm. Accessed February 10, 2015.

Federal Interagency Solutions Group (Federal Interagency Solutions Group, Oil Budget Calculator Science and Engineering Team). 2010. Oil Budget Calculator, *Deepwater Horizon*. Technical Documentation. A Report to the National Incident Command.

Feely, R.A., S.C. Doney, and S.R. Cooley. 2009. Ocean Acidification: Present Conditions and Future Changes in a High-CO_2 World. Oceanography, Vol. 2, No 4. Pp 36-47.

Feely, R.A., S.C. Doney, and S.R. Cooley. 2009. Ocean Acidification: Present Conditions and Future Changes in a High-CO_2 World. Oceanography 22(4):1-47.

Feldman, G. C., and C. R. McClain. 2015. Ocean Color Web, MODIS Aqua, 3 (4km), NASA Goddard Space Flight Center. Eds. Kuring, N. and S.W. Bailey. Available online at http://oceancolor.gsfc.nasa.gov/. Accessed June 23, 2015.

Ferguson, M.C., C. Curtice, J. Harrison, and S.M. Van Parijs. 2015. Biologically Important Areas for cetaceans within U.S. waters - overview and rationale. Aquatic Mammals 41:2-16.

Finley, K.J. 1990. The impacts of vessel traffic on the behaviour of belugas. In For the Future of the Beluga, Proceedings of the International Forum for Future of the Beluga. J. Prescott and M. Gauquelin (eds.). Presses de l'Université du Quebéc. pp. 133-140.

Fischbach, A.S., Kochnev, A.A., Garlich-Miller, J.L., and Jay, C.V. 2016. Pacific walrus coastal haulout database, 1852-2016—Background report: U.S. Geological Survey Open-File Report 2016–1108, 27 p. doi:10.3133/ofr20161108.

Fish M.R., I.M. Cote, J.A. Gill, A.P. Jones, S. Renshoff, and A.R. Watkinson. 2005. Predicting the impact of sea-level rise on Caribbean sea turtle nesting habitat. Conservation Biology. Volume 19, No. 2. Pp. 482-491.

Fisher, C.R. 1995. Characterization of habitats and determination of growth rate and approximate ages of the chemosynthetic symbiont-containing fauna. In: MacDonald, I.R., W.W. Schroeder, and J.M. Brooks, eds.1995. Chemosynthetic ecosystems study: Final report. Volume 2: Technical report. U.S. Department of the Interior, Minerals Management Service, Gulf of Mexico OCS Region, New Orleans, LA. OCS Study MMS 95-0022. pp. 5.1-5.47.

Fisher, C.R., P-Y Hsing, C.L. Kaiser, D.R. Yoerger, H.H. Roberts, W.W. Shedd, E.E. Cordes, T.M. Shank, S.P. Berlet, M.G. Saunders, E.Z. Larcom, J.M. Brooks. 2014. Footprint of Deepwater Horizon blowout Impact to Deep-water Coral Communities. Proceedings of the National Academies of Sciences. Vol. 111, No. 32. Pp. 11744-11749. Available online at http://www.pnas.org/content/111/32/11744.full.pdf. Accessed August 17, 2016.

Flanagan, B.E., E.W. Gregory, E.J. Hallisey, J.L. Heitgerd, and B. Lewis. 2011. A social vulnerability index for disaster management. Journal of Homeland Security and Emergency Management, 8(1). Article 3. Available online at http://gis.cdc.gov/grasp/svi/A%20Social%20 Vulnerability%20Index%20for%20Disaster%20Management.pdf. Accessed August 20, 2016.

Fodrie, F.J., K.W. Able, F. Galvez, K.L. Heck, Jr., O.P. Jensen, P.C. Lopez-Duarte, C.W. Martin, R.E. Turner, and A. Whitehead. 2014. Integrating Organismal and Population Responses of Estuarine Fishes in Macondo Spill Research. BioScience 64(9): 778-788.

Fonseca, M.S., W.J. Kenworthy, E. Griffith, M.O. Hall, M. Finkbeiner, S.S. Bell. 2008 Factors Influencing Landscape Pattern of the Seagrass *Haolphila decipiens* in an Oceanic Setting. Estuarine, Coastal and Shelf Science, 76, 163-174.

Foote, Berit Arnestad. 1992. The Tigara Eskimos and their Environment. Point Hope, AK: North Slope Borough Commission on Iñupiat History, Language and Culture. Print.

Forbes, D.L., H. Kremer, H. Lantuit, V. Rachold and L.O. Reiersen. 2011. State of the Arctic Coast 2010: Scientific Review and Outlook. Land-Ocean Interactions in the Coastal Zone, Institute of Coastal Research, Geesthacht, Germany. 168 pp. Available online at http://library.arcticportal.org/1277/1/state_of_the_arctic_coast_2010.pdf. Accessed December 14, 2015.

Frazier, J., T. Linton, and R. Webster. 2015. Advanced Prediction of the Intra-Americas *Sargassum* Season Through Analysis of the *Sargassum* Loop System Using Remote Sensing Technology. American Shore and Beach. 83(4):15-21.

Fritts, T.H., A.B. Irvine, R.D. Jennings, L.A. Collum, W. Hoffman, and M.A. McGehee. 1983b. Turtles, birds, and mammals in the northern Gulf of Mexico and nearby Atlantic waters. An overview based on aerial surveys of OCS areas, with emphasis on oil and gas effects. Contract No. 14-16-0009-81-949. 454 pp.

Fritts, T.H., W. Hoffman, and M.A. McGehee. 1983a. The distribution and abundance of marine turtles in the Gulf of Mexico and nearby Atlantic waters. Journal of Herpetology 17:327- 344.

Fucik, K.W., K.A. Carr, and B.J. Balcom. 1995. Toxicity of oil and dispersed oil to the eggs and larvae of seven marine fish and invertebrates from the Gulf of Mexico. In P. Lane (ed.) The use of Chemicals in Oil Spill Response, ASTM 1252. American Society for Testing and Materials. Philadelphia, PA. 343 pp.

Fugro Consultants, Inc. 2015. Virginia Oil and Gas Readiness Study. Available online at https://www.dmme.virginia.gov/dgmr/pdf/VirginiaOffshoreOilandGasReadinessStudyFinal.pdf. Accessed September 5, 2016.

Galginaitis, M. 2014. Monitoring Cross Island whaling activities, Beaufort Sea, Alaska: 2008-2012 Final Report, incorporating ANIMIDA and cANIMIDA (2001-2007). Prepared by Applied Sociocultural Research, Anchorage, AK. OCS Study BOEM 2013-218.

Galginaitis, Michael. 2009. Annual Assessment of Subsistence Bowhead Whaling near Cross Island, 2001-2007, Final Report. USDOI, MMS. OCS Study MMS 2009-038.

Gall, A.E., R.H. Day, T.J. Weingartner. 2013. Structure and variability of the marine-bird community in the northeastern Chukchi Sea. Continental Shelf Research, 67 (2013), pp. 96–115.

Gallant, A.L., E.F. Binnian, J.M. Omernik, and M.B. Shasby. 1995. Ecoregions of Alaska. U.S. Geological Survey Professional Paper 1567. Washington, D.C. Available online at http://pubs.usgs.gov/pp/1567/report.pdf. Accessed August 8, 2016.

Gallaway, B.J., W.J. Gazey, J.G. Cole, and R.G. Fechhelm. 2007. Estimation of Potential Impacts from Offshore Liquefied Natural Gas Terminals on Red Snapper and Red Drum Fisheries of the Gulf of Mexico: An Alternative Approach. Transactions of the American Fisheries Society 136:655-677.

Garber, S.D. 1985. The integration of ecological factors affecting marine turtle nesting beach management. In: Proceedings of the Ninth Annual Conference of the Coastal Society, October 14-17, 1984. Atlantic City, NJ: The Coastal Society.

Garner, G.W. and P.E. Reynolds, eds. 1986. Arctic National Wildlife Refuge coastal plain resource assessment: final report: baseline study of the fish, wildlife and their habitats. Anchorage, AK: USDOI, FWS, Region 7, 695 pp.

Gattuso, J.P. and L. Hansson. 2011. Ocean acidification: background and history. IN: Gattuso, J.P. and L. Hansson, editors. Ocean acidification. Oxford University Press, Oxford. pp. 1-20.

Geraci, J.R. and D.J. St. Aubin. 1987. Effects of offshore oil and gas development on marine mammals and turtles. In: Boesch, D.F. and N.N. Rabalais, eds. Long term environmental effects of offshore oil and gas development. London and New York, NY: Elsevier Applied Science Publ. Ltd. Pp. 587-617.

Gill, R.D., Jr. and T. Lee Tibbitts. 1999. Seasonal shorebird use of intertidal habitats of Cook Inlet, Alaska. Final Report. OCS Study. MMS 99-0012. 55 pp. Available online at http://www.boem.gov/BOEM-Newsroom/Library/Publications/1999/99_0012.aspx. Accessed September 1, 2016.

Gill, R.E., P.S. Tomkovich, and B.J. McCaffery. 2002. Rock Sandpiper (*Calidris ptilocnemis*). In: A. Poole and F. Gill (editors). The Birds of North America, No. 686. The Academy of Natural Sciences, Philadelphia, PA, and The American Ornithologists' Union.

Gittings, S.R., T.J. Bright, W.W. Schroeder, W.W. Sager, J.S. Laswell, and R. Rezak. 1992. Invertebrate assemblages and ecological controls on topographic features in the northeast Gulf of Mexico. Bulletin of Marine Science 50(3):435-455.

Glass, R.L., T.P. Brabets, S.A. Frenzel, M.S. Whitman and R.T. Ourso. 2004. Water quality in the Cook Inlet Basin, Alaska, 1998-2001. U.S. Geological Survey Circular 1240, Reston, VA. 32 pp. Available online at http://pubs.usgs.gov/circ/2004/1240/pdf/circular1240.pdf. Accessed December 16, 2015.

GMFMC (Gulf of Mexico Fishery Management Council). 1982. Fishery Management Plan for Coral and Coral Reefs of the Gulf of Mexico and South Atlantic. Gulf of Mexico Fishery Management Council, Tampa, FL 227 pp. + apps.

GMFMC and SAFMC (South Atlantic Fisheries Management Council). 1983. Fishery management plan final environmental impact statement, regulatory impact review, final regulations for the coastal migratory pelagics (mackerels) in the Gulf of Mexico and South Atlantic region. South Atlantic Fishery Management Council and Gulf of Mexico Fishery Management Council. 311 pp.

GMFMC. 2005. Final generic amendment number 3 for addressing Essential Fish Habitat requirements, Habitat Areas of Particular Concern, and Adverse Effects of Fishing in the following Fishery Management Plans of the Gulf of Mexico: Shrimp Fishery of the Gulf of Mexico, United States Waters; Red Drum Fishery of the Gulf of Mexico; Reef Fish Fishery of the Gulf of Mexico; Coastal Migratory Pelagic Resources (Mackerels) in the Gulf of Mexico and South Atlantic; Stone Crab Fishery of the Gulf of Mexico; Spiny Lobster in the Gulf of Mexico and South Atlantic; Coral and Coral Reefs of the Gulf of Mexico. National Oceanic and Atmospheric Award No. NA03NMF4410028.

Godfrey, P. J. 1976. Comparative ecology of east coast barrier islands: Hydrology, soil, vegetation. Technical Proceedings of the 1976 Barrier Island Workshop. J. Clark. Annapolis, MD. The Conservation Foundation: 5-34.

Godley et al. (Godley, B.J., C. Barbosa, M.W. Bruford, A.C. Broderick, P. Catry, M.S. Coyne, A. Formia, G.C. Hays, and M.J. Witt). 2010. Unravelling migratory connectivity in marine turtles using multiple methods. Journal of Applied Ecology 47: 769–778.

Godley et al. (Godley, B.J., E.H.S.M. Lima, S. Akesson, A.C. Broderick, F. Glen, M.H. Godfrey, P. Luschi, and G.C. Hays). 2003. Movement patterns of green turtles in Brazilian coastal waters described by satellite tracking and flipper tagging. Marine Ecology Progress Series 253:279–288.

Godley et al. (Godley, B.J., J. Blumenthal, A.C. Broderick, M.S. Coyne, M.H. Godfrey, L.A. Hawkes, and M.J. Witt). 2008. Satellite tracking of sea turtles: where have we been and where do we go next? Endangered Species Research 4(1-2):3–22.

Goldstein, B.D., H.J. Osofsky, and M.Y. Lichtveld. 2011. The gulf oil spill. New England Journal of Medicine 364(14): 1334–1348.

Gower, J., and S. King. 2011. Distribution of floating *Sargassum* in the Gulf of Mexico and Atlantic Ocean mapped using MERIS. International Journal of Remote Sensing 32:1917–1929.

Gower, J.F.R. and S.A. King. 2008. Satellite Images Show the Movement of Floating *Sargassum* in the Gulf of Mexico and Atlantic Ocean. 13pp. Available online at http://precedings.nature.com/ documents/1894/version/1/files/npre20081894-1.pdf. Accessed November 5, 2013.

Gower, J.F.R., C.M. Hu, G. Borstad, and S. King. 2006. Ocean color satellites show extensive lines 491 of floating *Sargassum* in the Gulf of Mexico. IEEE Transactions on Geoscience and Remote Sensing 44: 3619-3625.

Gower, J.F.R., E. Young, and S.A. King. 2013. Satellite images suggest a new *Sargassum* source region in 2011, Remote Sensing Letters, 4(8): 764-773.

Gradinger, R. 2009. Sea ice algae: major contributors to primary production and algal biomass in the Chukchi and Beaufort Sea during May/June 2002. Deep-Sea Research II: Topical Studies in Oceanography 56(17): 1201-1212.

Gradinger, R.R., and B.A. Bluhm. 2004. In-situ observations on the distribution and behavior of amphipods and arctic cod (*Boreogadus saida*) under the sea ice of the High Arctic Canadian Basin. Polar Biology 27:595–603.

Grattan, L. M., S. R. W. T. Mahan Jr., P. K. McLaughlin, W. S. Otwell, J. G. Morris, Jr. 2011. The Early Psychological Impacts of the Deepwater Horizon Oil Spill on Florida and Alabama Communities. Environmental Health Perspectives. doi: 10.1289/ehp.1002915.

Greater LaFourche Port Commission. 2016. Economic Development. Available online at http://portfourchon.com/seaport/economic-development/. Accessed August 3, 2016.

Grebmeier, J.M., and K.H. Dunton. 2000. Benthic processes in the northern Bering/Chukchi seas: status and global change. Impacts of changes in sea ice and other environmental parameters in the Arctic, 18-93.

Grebmeier, J.M., L.W. Cooper, H.M. Feder, and B.I. Sirenko. 2006. Ecosystem dynamics of the Pacific-influenced northern Bering and Chukchi Seas in the Amerasian Arctic. Progress in Oceanography 71.2: 331-361.

Greene, C.R.,Jr. and S.E. Moore. 1995. Man-made Noise. IN Marine Mammals and Noise. W.J. Richardson, C.R.J. Greene, C.I. Malme and D.H. Thomson (eds.). Academic Press, San Diego. pp 101-158.

Greene, C.R.,Jr. and W.J. Richardson. 1988. Characteristics of marine seismic survey sounds in the Beaufort Sea. Journal of the Acoustical Society of America 83: 2246-2254.

Greiner, A. L. Lagasse, L. P., Neff, R. A., Love, D. C., Chase, R., Sokol, N. Smith, K. C. 2013. Reassuring or risky: the presentation of seafood safety in the aftermath of the British Petroleum Deepwater Horizon Oil Spill. Am. J. Public Health. 2013 Jul;103(7):1198-206. doi: 0.2105/AJPH.2012.301093. Epub 2013 May 16.

Grimes, C.B. 2001. Fishery Production and the Mississippi River Discharge, Fisheries, 26:8, 17-26.

Gulf of Mexico Foundation. 2016. Gulf of Mexico Facts. Available online at http://www.gulfmex.org/about-the-gulf/gulf-of-mexico-facts/. Accessed September 1, 2016.

Gulf Restoration Network. 2004. A Guide to Protecting Wetlands in the Gulf of Mexico. Update to Spring 2001. 43 pp. Available online at http://healthygulf.org/sites/default/files/ A_Guide_to_Protecting_Wetlands_in_the_Gulf_of_Mexico.pdf. Accessed August 25, 2015.

Hall, J. V., W. E. Frayer and B. O. Wilen. 1994. Status of Alaska wetlands. Alaska Region.

Hammill, M.O. and T.G. Smith. 1991. The role of predation in the ecology of the ringed seal in Barrow Strait, Northwest Territories, Canada. Marine Mammal Science 7:123-135.

Handley, L., K.A. Spear, C. Thatcher, and S. Wilson. 2012. Emergent Wetlands Status and Trends in the Northern Gulf of Mexico, 1950-2010. USGS Scientific Investigations Report. Available online at http://gom.usgs.gov/GOMEmWetStatusTrends.aspx. Accessed February 10, 2015.

Haney, J.C., H.J. Geiger, and J.W. Short. 2014. Bird mortality from the *Deepwater Horizon* oil spill. I. Exposure probability in the offshore Gulf of Mexico. Marein Eco Prog Ser. 513:225 – 237.

Hansen, J., M. Sato, P. Hearty, R. Ruedy, M. Kelley, V. Masson-Delmotte, G. Russell, G. Tselioudis, J. Cao, E. Rignot, I. Velicogna, B. Tormey, B. Donovan, E. Kandiano, K. von Schuckmann, P. Kharecha, A. N. Legrande, M. Bauer, and K-W. Lo. 2016, Ice melt, sea level rise and superstorms: evidence from paleoclimate data, climate modeling, and modern observations that 2oC global warming could be dangerous, Atmospheric Chemistry and Physics, http://www.atmos-chem-phys.net/16/3761/2016/acp-16-3761-2016.pdf. Accessed August 3, 2016.

Harding, L.E. 1976. Den-site characteristics of arctic coastal grizzly bears (*Ursus arctos*) on Richards Island, Northwest Territories, Canada. Canadian Journal of Zoology, 54(8), pp.1357-1363.

Harper, P. 2013. Caribou management report of survey-inventory activities 1 July 2010-30 June 2012. Alaska Department of Fish and Game, Species Management Report ADF&G/DWC/SMR-2013-3, Juneau. Available online at http://www.adfg.alaska.gov/static/home/library/pdfs/wildlife/ mgt_rpts/2013_caribou_management_report_survey_inventory_activities.pdf. Accessed July 7, 2016.

Harper, P. and L.A. McCarthy, editors. 2014. Moose management report of survey-inventory activities 1 July 2011-30 June 2013. Alaska Department of Fish and Game, Species Management Report ADF&G/DWC/SMR-2014-6, Juneau. Available online at http://www.adfg.alaska.gov/index.cfm?adfg=wildliferesearch.smr20146. Accessed August 16, 2016.

Harper, P. and L.A. McCarthy, editors. 2015. Caribou management report of survey-inventory activities 1 July 2012-30 June 2014. Alaska Department of Fish and Game, Species Management Report ADF&G/DWC/SMR-2015-4, Juneau. Available online at http://www.adfg.alaska.gov/index.cfm?adfg=wildliferesearch.smr20154. Accessed July 6, 2016.

Hart, K.M, M.M. Lamont, A.R Sartain, I. Fujisaki. 2014. Migration, Foraging, and Residency Patterns for Northern Gulf Loggerheads: Implications of Local Threats and International Movements. PLoS ONE 9(7): e103453. doi:10.1371/journal.pone.0103453.

Hart, K.M., and I. Fujisaki. 2010. Satellite tracking reveals habitat use by juvenile green sea turtles *Chelonia mydas* in the Everglades, Florida, USA. Endangered Species Research 11(3):221-32.

Hart, K.M., M.M. Lamont, A.R. Sartain, I. Fujisaki, B.S. Stephens. 2013. Movements and Habitat-Use of Loggerhead Sea Turtles in the Northern Gulf of Mexico during the Reproductive Period. PLoS ONE 8(7): e66921. doi:10.1371/journal.pone.0066921.

Hart, R.A. and J.M. Nance. 2012. Three decades of U.S. Gulf of Mexico white shrimp, *Litopenaeus setiferus*, commercial catch statistics. Marine Fisheries Review 75(4): 43-47.

Hauser, D. D., K. L. Laidre, R. S. Suydam, and P. R. Richard. 2014. Population-specific home ranges and migration timing of Pacific Arctic beluga whales (*Delphinapterus leucas*). Polar Biology: 1-13.

Hayes, M.O., R. Hoff, J. Michel, D. Scholz, and G. Shigenaka. 1992. An Introduction to Coastal Habitats and Biological Resources for Oil Spill Response. Report No. HNRAD 92-4, Hazardous Materials Response and Assessment Division, National Oceanic and Atmospheric Administration, Seattle, WA. 401 pp.

Hemmerling, S.A. and C.E. Colten. 2004. Environmental justice considerations in Lafourche Parish, Louisiana: Final report. U.S. Dept. of the Interior, Minerals Management Service, Gulf of Mexico OCS Region, New Orleans, La. OCS Study MMS 2003-038. 354 pp.

Hennige, S.J., L.C. Wicks, N.A. Kamenos, D.C.E. Bakker, H.S. Findlay, C. Dumousseaud, J.M. Roberts. 2014. Short-term metabolic and growth responses of the cold-water coral *Lophelia pertusa* to ocean acidification. Deep-Sea Research II. 99: 27–35.

Hennige, S.J., L.C. Wicks, N.A. Kamenos, G. Perna, H.S. Findlay, and J.M Roberts. 2015. Hidden impacts of ocean acidification to live and dead coral framework. Proceedings of the Royal Society of London B 282:20150990.

Henry, J.M. and C.L. Bankston III. 2002. Blue Collar Bayou: Louisiana Cajuns in the New Economy of Ethnicity. Praeger Publishers. Westport CT. 245 pp.

Hess N.A. and C.A. Ribic. 2000. Seabird ecology In: Davis R.W., W.E. Evans, B. Würsig (eds). Cetaceans, sea turtles and seabirds in the northern Gulf of Mexico: distribution, abundance and habitat associations, Vol II. Tech Rep USGS/BRD/CR-1999-0006 (OCS Study MMS 2000-003). US Dept of the Interior, Geological Survey, Biological Resources Division, and Minerals Management Service, Gulf of Mexico OCS Region, New Orleans, LA. p. 275−316.

Hicks, J. and P. Bjerregaard. 2006. The Transition from the Historical Inuit Suicide Pattern to the Present Inuit Suicide Pattern. Accessed online on Nov. 13, 2006, at http://www.inchr.org/Doc/April2006/Hickssuicide.pdf Accessed November 13, 2006.

Hildebrand, J.A. 2009. Anthropogenic and natural sources of ambient noise in the ocean. Marine Ecology Progress Series 395:5-20.

Hill, V., G. Cota, and D. Stockwell. 2005. Spring and summer phytoplankton communities in the Chukchi and Eastern Beaufort Seas. Deep-Sea Research II: Topical Studies in Oceanography 52:3369–3385.

Hine, A.C., G.R. Brooks, R.A. Davis, Jr., L.J. Doyle, G. Gelfenbaum, S.D. Locker, D.C. Twichell, and R.H. Weisberg. 2001. A summary of findings of the west-central Florida coastal studies project. USGS Open File Report 01-303. Available online at http://pubs.usgs.gov/of/2001/of01-303/index.html. Accessed February 12, 2015.

Hoffman, J.I., L.S. Peck, G. Hillyard, A. Zieritz, and M.S. Clark. 2010. No evidence for genetic differentiation between Antarctic limpet *Nacella concinna* morphotypes. Marine Biology 157:765-778.

Hopcroft, R., B. Bluhm and R. Gradinger. 2008. Arctic Ocean Synthesis: Analysis of Climate Change Impacts in the Chukchi and Beaufort Seas with Strategies for Future Research. Institute of Marine Sciences, University of Alaska, Fairbanks. 184 pp. Available online at http://www.arcodiv.org/news/NPRB_report2_final.pdf. Accessed September 1, 2016.

Horner, R.A., S.F. Ackley, R. Horner, S.F. Ackley, G.S. Dieckmann , B. Guiliksen, T. Hoshia, L. Legendre, I.A. Melnikov, W.S. Reeburgh, M. Spindler and C.W. Sullivan. 1992. Ecology of sea ice biota. Habitat, terminology and methodology. Polar Biology. 12:417-427.

Hsing, P., B. Fu., E.A. Larcom, S.B. Berlet, T.M. Shank, A.F. Govindarajan, A.J. Lukasiewicz, P.M. Dixon, and C.R. Fisher. 2013. Evidence of lasting impact of the Deepwater Horizon oil spill on a deep Gulf of Mexico coral community. Elementa, Science of the Anthropocene 1:000012. doi: 10.12952/journal.elementa.000012.

Huntington, H.P. and L.T. Quakenbush. 2009. Traditional knowledge of bowhead whale migratory patterns near Kaktovik and Barrow, Alaska. Final report to the Barrow and Kaktovik Whaling Captains Associations, the Alaska Eskimo Whaling Commission, ConocoPhillips, and the Minerals Management Service. 13pp.

Huntington, Henry P. 2013. Traditional Knowledge Regarding Bowhead Whales and Camden Bay, Beaufort Sea, Alaska. August 5, 2013.

IAI (Impact Assessment, Inc.) 1990-a Northern Institutional Profile Analysis: Beaufort Sea. OCS Study MMS 90-0023. Anchorage, AK: USDOI, MMS, Alaska OCS Region.

IAI, 1990-b (Impact Assessment, Inc.) Northern Institutional Profile Analysis: Chukchi Sea. OCS Study, MMS 90-0022. Anchorage, AK: USDOI, MMS, Alaska OCS Region.

ICCT (International Council on Clean Transportation). 2015. A 10-Year Projection of Maritime Activity in the U.S. Arctic Region. January 1, 2015.

IEA (International Energy Agency). 2015a. World Energy Outlook 2015. International Energy Agency. Paris, France. PDF 978-92-24366-8. 718 pp.

IEA. 2015b. Energy and Climate Change. World Energy Outlook Special Report. Available online at https://www.iea.org/publications/freepublications/publication/WEO2015SpecialReportonEnergyandClimateChange.pdf. Accessed August 18, 2016.

Incardona, J.P., L.D. Gardner, T.L. Linbo, T.L. Brown, A.J. Esbaugh, E.M. Mager, J.D. Stieglitz, B.L. French, J.S. Labenia, C.A. Laetz, M. Tagal, C.A. Sloan, A. Elizur, D.D. Bennetti, M. Grosell, B.A. Block, and N.L. Scholz. 2014. Deepwater Horizon crude oil impacts the developing hearts of large predatory pelagic fish. Proceedings of the National Academy of Sciences 111(15):E1510-E1518.

Industrial Economics, Inc. 2015. Consumer Surplus and Energy Substitutes for OCS Oil and Gas Production: The 2015 Revised Market Simulation Model (MarketSim). OCS Study BOEM 2015-054.

Industrial Economics, Inc. and SC&A, Inc. 2015. Forecasting Environmental and Social Externalities Associated with Outer Continental Shelf (OCS) Oil and Gas Development -- Volume 2: Supplemental Information to the 2015 Revised Offshore Environmental Cost Model (OECM). OCS Study BOEM 2015-053.

Industrial Economics, Inc. et al. (Industrial Economics, Inc.; Applied Sciences Associates, Inc.; Northern Economics; Dr. Nicholas Z. Muller; and SC&A, Inc). 2015. Forecasting Environmental and Social Externalities Associated with Outer Continental Shelf (OCS) Oil and Gas Development - Volume 1: The 2015 Revised Offshore Environmental Cost Model (OECM). OCS Study BOEM 2015-052.

IPCC (International Panel on Climate Change). 2007. Climate Change 2007: Synthesis Report. Contribution of Working Groups I, II and III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change.

IPCC. 2014. Climate Change 2014: Impacts, Adaptation, and Vulnerability. Parts A and B: Global and Sectoral Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change. Field, C.B., V.R. Barros, D.J. Dokken, K.J. Mach, M.D. Mastrandrea, T.E. Bilir, M. Chatterjee, K.L. Ebi, Y.O. Estrada, R.C. Genova, B. Girma, E.S. Kissel, A.N. Levy, S. MacCracken, P.R. Mastrandrea, and L.L. White (eds.). Cambridge University Press. Cambridge, United Kingdom and New York, NY, USA. 1820 pp.

IPCC. 2016. Fifth assessment report (AR5). Available online at http://www.ipcc.ch/. Accessed June 28, 2016.

Ishimatsu, A., Hayashi, M. and Kikkawa, T. 2008. Fishes in high CO_2, acidified oceans. Marine Ecology Progress Series. 373: 295-302.

Iwamura T., H.P. Possingham, I. Chade`s, C. Minton, N.J. Murray, D.I. Rogers, E.A. Treml, and R.A. Fuller. 2013. Migratory connectivity magnifies the consequences of habitat loss from sea-level rise for shorebird populations. Proc R Soc B. 280:20130325.

Jandt, R., K. Joly, C.R. Meyers, and C. Racine. 2008. Slow recovery of lichen on burned caribou winter range in Alaska tundra: potential influences of climate warming and other disturbance factors. Arctic, Antarctic and Alpine Research. 40:89-95.

Jay, C.V., A.S. Fischbach, and A.A Kochnev. 2012. Walrus areas of use in the Chukchi Sea during sparse sea ice cover. Marine Ecology Progress Series 468:1-13.

Jefferies, M. O. and J. Richter-Menge. 2015. The Arctic. State of the Climate in 2014: S127-S148.

Jefferson et al. (Jefferson, T.A., M.A. Webber, and R. L. Pitman), eds. 2015. Marine Mammals of the World: A Comprehensive Guide to their Identification, Second Edition. Elsevier.

Ji, Z.-G. 2004. Use of Physical Sciences in Support of Environmental Management. Environmental Management 34(2):159–169.

Ji, Z-G., W.R. Johnson, and G.L. Wikel. 2014. Statistics of Extremes in Oil Spill Risk Analysis. Environ. Sci. Technol. 48(17):10505–10510.

Johnson, C.B., M.T. Jorgenson, R.M. Burgess, B.E. Lawhead, J.R. Rose, and A.A. Stickney. 1996. Wildlife Studies on the Colville River Delta, 1995. Fourth Annual Report. Anchorage, AK: ARCO Alaska, Inc. and the Kuparuk Unit Owners, 154 pp.

Johnson, W.R., C.F. Marshall and E.M. Lear. 2000. Oil-Spill Risk Analysis: Liberty Development and Production Plan. OCS Report MMS 2000-082. U.S. Department of the Interior, Minerals Management Service.

Joung, D. and A.M. Shiller. 2013. Trace Element Distributions in the Water Column near the Deepwater Horizon Well Blowout. Environmental Science & Technology 47(5):2161-2168.

Joye , S.B., A. Bracco , T. M. Özgökmen , J. P.Chanton, M. Grosell, I. R. MacDonald, E. E.Cordes, J. P. Montoya, U. Passow. 2016. The Gulf of Mexico ecosystem, six years after the Macondo oil well blowout. Deep-Sea Research 129:4-19.

Joye, S.B., I. Leifer, I.R. MacDonald, J.P. Chanton, C.D. Meile, A.P. Teske, J.E. Kostka, L. Chistoserdova, R. Coffin, and D. Hollander. 2011b. Comment on “A Persistent Oxygen Anomaly Reveals the Fate of Spilled Methane in the Deep Gulf of Mexico.” Science 332(6033):1033.

Joye, S.B., I.R. MacDonald, I. Leifer, V. Asper. 2011a. Magnitude and oxidation potential of hydrocarbon gases released from the BP oil well blowout. Nature Geoscience 4(3):160-164.

Karlsen, J., A. Bisther, C. Lydersen, T. Haug, and K. Kovacs. 2002. Summer vocalizations of adult male white whales (*Delphinapterus leucas*) in Svalbard, Norway. Polar Biology. 25(11): 808-817.

Karnauskas, M., M.J. Schirripa, C.R. Kelble, G.S. Cook, and J.K. Craig, eds. 2013. Ecosystem Status Report for the Gulf of Mexico. NOAA Technical Memorandum NMFS-SEFSC-653. 52 pp.

Karnauskas, M., M.J. Schirripa, J.K. Craig, G.S. Cook, C.R. Kelble, J.J. Agar, B.A. Black, D.B. Enfield, D. Lindo-Atichati, B.A. Muhling, K,M. Purcell, P.M. Richards, C. Wang. 2015. Evidence of climate-driven ecosystem reorganization in the Gulf of Mexico. Global Change Biology 21: 2554-2568.

Kennicutt, M.C., P.N. Boothe, T.L. Wade, S.T. Sweet, R. Rezak, F.J. Kelly, J.M. Brooks, B.J. Presley and D.A. Wiesenburg. 1996. Geochemical patterns in sediments near offshore production platforms. Canadian Journal of Fisheries and Aquatic Sciences 53: 2554-2566.

Kessler, J.D., D.L. Valentine, M.C. Redmond, and M. Du. 2011b. Response to Comment on “A Persistent Oxygen Anomaly Reveals the Fate of Spilled Methane in the Deep Gulf of Mexico.” Science 332. 27 May 2011. p. 1033d.

Kessler, J.D., D.L. Valentine, M.C. Redmond, M. Du, E.W. Chan, S.D. Mendes, E.W. Quiroz, C.J. Villanueva, S.S. Shusta, L.M. Werra, S. Yvon-Lewis, and T.C. Weber. 2011a. A persistent oxygen anomaly reveals the fate of spilled methane in the deep Gulf of Mexico. Science 331:312-315.

Khalil, S.M., C.W. Finkl, R.C. Raynie. 2013. Development of new restoration strategies for Louisiana barrier island systems, northern Gulf of Mexico, USA. IN: Conley, D.C., Masselink, G., Russell, P.E. and O’Hare, T.J. (eds.), Proceedings 12th International Coastal Symposium (Plymouth, England), Journal of Coastal Research, Special Issue. No. 65, pp. 1467-1472, ISSN 0749-0208. Available online at http://ics2013.org/papers/Paper3779_rev.pdf. Accessed September 1, 2016.

King, T.F. 2000. What should be the “Cultural Resources” Element of an EIA? Environmental Impact Assessment Review, 20, 5-30.

Kirby, R.R., G. Beaugrand, J.A. Lindley, A.J. Richardson, M. Edwards, and P.C. Reid. 2007. Climate effects and benthic-pelagic coupling in the North Sea. Marine Ecology Progress Series 330: 31–38.

Klein, David R. 1999. The Roles of Climate and Insularity in Establishment and Persistence of *Rangifer tarandus* Populations in the High Arctic. Ecological Bulletins 47 (1999): 96-104.

Klem, D., Jr. 1989. Bird-Window Collisions. Wilson Bulletin. 101:606–620.

Klem, D., Jr. 1990. Collisions between Birds and Windows: Mortality and Prevention. Journal of Field Ornithology. 61:120–128.

Koch, J.C. 2016. Lateral and subsurface flows impact arctic coastal plain lake water budgets. Hydrological Processes, in press. doi:10.1002/hyp.10917.

KPB (Kenai Peninsula Borough). 2015. Kenai Peninsula Borough - Fixed Wing Imagery. Available online at http://www.kpb.us/images/KPB/GIS/PrintMaps/Borough/General.pdf. Accessed June 27, 2016.

Kroeker, K.J., R. L. Kordas, R. N. Crim and G. G. Singh. 2010. Meta-analysis reveals negative yet variable effects of ocean acidification on marine organisms. Ecology Letters 13: 1419–1434.

Kujawinski, E.B., M.C. Kido Soule, D.L. Valentine, A.K. Boysen, K. Longnecker, and M.C. Redmond. 2011. Fate of Dispersants Associated with the Deepwater Horizon Oil Spill. Environmental Science and Technology 45:1298–1306.

Kuletz, J., M.C. Ferguson, B. Hurley, A.E. Gall, E.A. Labunski, and T.C. Morgan. 2015. Seasonal spatial patterns in seabird and marine mammal distribution in the eastern Chukchi and western Beaufort seas: identifying biologically important pelagic areas. Progress in Oceanography136:175–200.

Kushmaro, A., G. Henning, D.K. Hofmann, Y. Benayahu. 1997. Metamorphosis of *Heteroxenia fuscescens* Planulae (Cnidaria: Octocorallia) is Inhibited by Crude Oil: A Novel Short Term Toxicity Bioassay. Marine Environmental Research, Vol. 43, no. 4, pp. 295-302.

Kvenvolden, K.A. and C.K. Cooper. 2003. Natural Seepage of Crude Oil into the Marine Environment. Geo-Marine Letters 23:140–146.

Kyle, R.E. and T.P. Brabets. Water temperature of streams in the Cook Inlet basin, Alaska, and implications of climate change. US Department of the Interior, US Geological Survey, 2001.

LaBrecque, E., C. Curtice, J. Harrison, S.M. Van Parijs, and Patrick N. Halpin. 2015. Biologically Important Areas for cetaceans within U.S. waters - Gulf of Mexico Region. Aquatic Mammals 41:30-38.

Larned, W.W. and D. Zwiefelhofer. 2001. Distribution and Abundance of Steller's Eiders (*Polysticta stelleri*) in the Kodiak Archipelago, Alaska Jan.-Feb., 2001. Unpublished report. U.S. Fish and Wildlife Service, Kodiak, AK. 11 pp.

LaRoe, E.T. 1976. Barrier islands as significant ecosystems. IN: Clark, J. ed. Technical Proceedings of the 1976 Barrier Island Workshop. The Conservation Foundation, Annapolis, MD. pp. 1-4.

LaSalle, M.W. 1998. Recognizing Wetlands in the Gulf of Mexico Region. Mississippi State University Cooperative Extension Service. Stennis Space Center MS. 24 pp. Available online at http://nepis.epa.gov/Exe/ZyPDF.cgi/2000551Y.PDF?Dockey=2000551Y.PDF. Accessed September 1, 2016.

Lawhead, B.E. and Johnson, C.B. 2000. Surveys of caribou and muskoxen in the Kuparuk-Colville Region, Alaska, 1999, with a summary of caribou calving distribution since 1993: Final Report. ABR, Incorporated.

Lee, M.R. and T.C. Blanchard. Community attachment and negative affective states in the context of the BP *Deepwater Horizon* disaster. American Behavioral Scientist 56(1): 24-47.

Lee, R.F., M. Koster, and G.A. Paffenhofer. 2012. Ingestion and defecation of dispersed oil droplets by pelagic tunicates. Journal Plankton Research. 34:1058-1063.

Lee, S.H., H. Dahms,Y. Kim, E. J. Choy, S. Kang, C. Kang. 2014. Spatial distribution of small phytoplankton composition in the Chukchi Sea. Polar Biology 37:99-109.

Lee, W.Y., K. Winters, and J.A.C. Nicol. 1978. The biological effects of the water soluble fractions of a No. 2 fuel oil on the planktonic shrimp, *Lucifer faxoni*. Environmental Pollution 15:167-183.

Lees, D.C. and W.B. Driskell. 2004. Annual Report for National Park Service Intertidal Reconnaissance Survey to Assess Composition, Distribution, and Habitat of Marine/Estuarine Infauna Inhabiting Soft Sediments in the Southwestern Alaska Network - Kenai Fjords National Park and Lake Clark National Park and Preserve. Prepared by Littoral Ecological & Environmental Services, for Southwest Alaska Network, National Park Service. 40 pp.

Lees, D.C., J.P. Houghton, D.E. Erickson, W.B. Driskell, and D.E. Boettcher. 1986. Ecological Studies of Intertidal and Shallow Subtidal Habitats in lower Cook Inlet, Alaska. Pages 1-436 in Outer Continental Shelf Environmental Assessment Program Final Reports of Principal Investigators Volume 44. U.S. Dept. of Commerce, National Oceanic and Atmospheric Administration, National Ocean Service, Office of Oceanography and Marine Assessment, Alaska Office and U.S. Dept. of the Interior, Minerals Management Service, Alaska OCS Region OCS Study MMS 86-0061, Anchorage, AK.

Lenart, E.A. 2005a. Units 26B and 26C caribou management report. In: Caribou management report of survey and inventory activities 1 July 2002 to 30 June 2004, C. Brown, ed. Juneau, AK: State of Alaska, Department of Fish and Game, pp. 269-292.

Lenart, E.A. 2005b. Units 26B and 26C Muskoxen Management Report. In: Muskoxen management report of survey and inventory activities 1 July 2002 to 30 June 2004, C. Brown, ed. Project 16.0. Juneau, AK: State of Alaska, Department of Fish and Game, pp. 49- 68.

Lent, P.C. 1970. January. Muskox Maternal Behavior-A Preliminary Description. In American Zoologist (Vol. 10, No. 4, P. 481). 1041 New Hampshire St, Lawrence, Ks 66044: Amer Soc Zoologists.

Levin et al. (Levin, L.A., C.L. Huggett and K.F. Wishner). 1991. Control of deep sea benthic community structure by oxygen and organic-matter gradients in the eastern Pacific Ocean. Journal of Marine Research 52: 489-522.

Levitus, S., J.I. Antonov, T.P. Boyer, O.K. Baranova, H.E. Garcia, R.A. Locarnini, A.V. Mishonov, J.R. Reagan, D. Seidov, E.S. Yarosh, M.M. Zweng. 2012. World Ocean Heat Content and Thermosteric Sea Level Change (0–2000 m), 1955–2010. Geophysical Research Letters, Vol. 39, Issue, 10.

Lewison, R.L., B. Wallace, J. Alfaro-Shigueto, J.C. Mangel, S.M Maxwell, and E.L. Hazen. 2013. Fisheries bycatch of marine turtles: Lessons learned from decades of research and conservation. In: Wyneken, J., K.J. Lohmann, J.A. Musick. The biology of sea turtles. Volume III. Pp. 329-351.

Lewison, R.L., L.B. Crowder, B.P. Wallace, J.E. Moore, T. Cox, R. Zydelis, S. McDonald, A. DiMatteo, D.C. Dunn, C.Y. Kot, R. Bjorkland, S. Kelez, C. Coykan, K.R. Stewart, M. Sims, A. Boustany, A.J. Read, P. Halpin, and W.J. Nichols. 2014. Global patterns of marine mammal, seabird, and sea turtle bycatch reveal taxa-specific and cumulative megafauna hotspots. Proceedings of the National Academy of Sciences. 6 pp.

Liebezeit, J., E. Rowland, M. Cross, and S. Zack. 2012. Assessing Climate Change Vulnerability of Breeding Birds in Arctic Alaska. A report prepared for the Arctic Landscape Conservation Cooperative. Wildlife Conservation Society, North America Program, Bozeman, MT. 167pp.

Lin, Q. and I.A. Mendelssohn. 2012. Impacts and Recovery of the Deepwater Horizon Oil Spill on Vegetative Structure and Function of Coastal Salt Marsh in the Northern Gulf of Mexico. Environmental Science and Technology 46(7): 3737-3743.

Linden, O. 1976. Effects of oil on the reproduction of the amphipod *Gammarus oceanicus*. Ambio 5:36-37.

Llopiz, J.K., R.K. Cowen, M.J. Hauff, R. Ji, P.L. Munday, B.A. Muhling, M.A. Peck, D.E. Richardson, S. Sogard, S. Sponaugle. 2014. Early Life History and Fisheries Oceanography: New Questions in a Changing World. Oceanography 27 (4), 26-41.

Logerwell, E., M. Busby, C. Carothers, S. Cotton, J. Duff-Anderson, E. Farley, P. Goddard, R. Heintz, B. Holladay, J. Horne, S. Johnson, B. Lauth, L. Moulton, D. Neff, B. Norcross, S. Parker-Stetter, J. Seigle, T. Sformo. 2015. Fish Communities across a Spectrum of Habitats in the Western Beaufort Sea and Chukchi Sea. Progress in Oceanography, 136, 115-132.

Long, M.C., C. Deutsch, T. Ito. 2016. Finding Forced Trends in Oceanic Oxygen. Global Biogeochem. Cycles, 30, 381-397.

Longcore, T., C. Rich, P. Mineau, B. MacDonald, D.G. Bert, L.M. Sullivan, E. Mutrie, S.A. Gauthreaux, M.L. Avery, R.L. Crawford, A.M. Manville, E.R. Travis, and D. Drake. 2013. Avian mortality at communication towers in the United States and Canada: which species, how many, and where? Biological Conservation. 158:410–419.

Loss, S. R., Will, T., & Marra, P.P. 2013. The impact of free-ranging domestic cats on wildlife of the United States. Nature Commun. 4, 1396.

Loss, S. R., Will, T., & Marra, P.P. 2014a. Estimation of bird vehicle collision mortality on US roads. The Journal of Wildlife Management. 78(5), 763-771.

Loss, S. R., Will, T., Loss, S. S., & Marra, P.P. 2014b. Bird-building collisions in the United States: Estimates of annual mortality and species vulnerability. The Condor. 116(1), 8-23.

Lovejoy, C. and M. Potvin. 2011. Microbial eukaryotic distribution in a dynamic Beaufort Sea and the Arctic Ocean. Journal of Plankton Research 33:431–444.

Lubchenco, J., M. McNutt, B. Lehr, M. Sogge, M. Miller, S. Hammond, and W. Conner. 2010. BP *Deepwater Horizon* Oil Budget: What Happened to the Oil? Available online at http://www.usgs.gov/foia/budget/08-03-2010...Oil%20Budget%20description%20FINAL.pdf. Accessed October 9, 2015.

Lugo-Fernandez, A., and R.E. Green. 2011. Mapping the Intricacies of the Gulf of Mexico's Circulation. EOS 92(3):21–22.

Lunden J.J, C.G. McNicholl, C.R. Sears, C.L. Morrison, and E.E. Cordes. 2014. Acute survivorship of the deep-sea coral *Lophelia pertusa* from the Gulf of Mexico under acidification, warming, and deoxygenation. Frontiers in Marine Science 1:1-12. doi: 10.3389/fmars.2014.00078.

Lunden, J.J., S.E. Georgian, and E.E. Cordes. 2013. Aragonite saturation states at cold-water coral reefs structured by *Lophelia pertusa* in the northern Gulf of Mexico. Limnology and Oceanography. 58(1), 354-362.

Lutcavage, M.E., P. Plotkin, B. Witherington, and P.L. Lutz. 1997. Human impacts on sea turtles. In: P.L. Lutz & J.A. Musick (Eds.). The Biology of Sea Turtles. CRC Press, Boca Raton, Florida, pp. 387-409.

Lutcavage, M.E., P.L. Lutz, G.D. Bossart, and D.M. Hudson. 1995. Physiologic and clinicopathologic effects of crude oil on loggerhead sea turtles. Archives of Environmental Contamination and Toxicolology 28:417-422.

Luton, H., and R. Cluck. 2003. Social Impact Assessment of Offshore Oil and Gas in the Gulf of Mexico, draft, Mineral Management Service.

Maantay, Juliana. Zoning Law, Health, and Environmental Justice: What's the Connection? The Journal of Law, Medicine & Ethics, 30.4 (2002): 572-93.

Macartney, S., A. Bishaw, and K. Fontenot. 2013. American Community Survey: Poverty rates for selected detailed race and Hispanic groups by state and place: 2007-2011. Available online at https://www.census.gov/prod/2013pubs/acsbr11-17.pdf. Accessed December 15, 2015.

MacCracken, J.G. 2012. Pacific walrus and climate change: observations and predictions. Ecology and Evolution 2:2072-2090.

MacIntosh R. 2009. Kodiak National Wildlife Refuge and the Kodiak Archipelago. Birds. Available online at http://www.fws.gov/uploadedFiles/Region_7/NWRS/Zone_2/Kodiak/PDF/knwr_bird_broc_2009.pdf. Accessed September 1, 2016.

Maersk Drilling. 2016. The Drilling Industry. Available online at http://www.maerskdrilling.com/en/about-us/the-drilling-industry. Accessed August 8, 2016.

Magee, J. and R. Nesbit. 2008. Proximate Causation and the No Action Alternative Trajectory in Cumulative Effects Analysis. Environmental Practice 10(3):107–115.

Mager, E.M., A.J. Esbaugh, J.D, Stieglitz, R. Hoenig, C. Bodinier, J.P. Incardona, N.L. Scholz, D.D. Bennetti, and M. Grosell. 2014. Acute embryonic or juvenile exposure to Deepwater Horizon crude oil impairs the swimming performance of mahi-mahi (*Coryphaena hippurus*). Environmental science & technology 48(12):7053-7061.

Mars, J.C. and D. W. Houseknecht. 2007. Quantitative remote sensing study indicates doubling of coastal erosion rate in past 50 year along a segment of the Arctic coast of Alaska. Geology. 35:583-586.

Martin, L. and B. Gallaway. 1994. The effects of the Endicott Development Project on the Boulder Patch, an arctic kelp community in Stefansson Sound, Alaska. Arctic, 47(1), 54–64.

Mathis, J.T., J.N. Cross, W. Evans, S.C. Doney. 2015. Ocean Acidification in the Surface Waters of the Pacific-Arctic Boundary Regions. Oceanography, 28(2):122-135. Available online at http://dx.doi.org/10.5670/oceanog.2015.36. Accessed July 15, 2016.

Matz, G. 2014. Kachemak Bay shorebird monitoring project: 2014 report. Available online at http://kachemakbaybirders.org/wp-content/uploads/2014/10/2014%20Kachemak%20Bay%20Shorebird%20Monitoring%20Project.pdf. Accessed September 7, 2016.

MBC Applied Environmental Sciences. 2003. Physical Oceanography of the Beaufort Sea – Workshop Proceedings. OCS Study MMS 2003-045. Prepared by MBC Applied Environmental Sciences, Costa Mesa, CA. Prepared for the U.S. Dept. of the Interior, Minerals Management Service, Alaska OCS Region, Anchorage, AK. 26 pp plus attachments.

McBride, R.A., S. Penland, M.W. Hiland, S.J. Williams, K.A. Westphal, B.J. Jaffe, and A.H. Sallenger. 1992. Analysis of barrier shoreline change in Louisiana from 1853 to 1989. In: Williams, S.J., S. Penland, and A.H. Sallenger, eds. Atlas of shoreline changes in Louisiana from 1853 to 1989. U.S. Department of the Interior, Geological Survey. Miscellaneous Investigation Series I-2150-A. pp. 36-97.

McCauley, R.D., J. Fewtrell, A.J. Duncan, C. Jenner, M-N. Jenner, J.D. Penrose, R.I.T. Prince, A. Adhitya, J. Murdoch and K. McCabe. 2000. Marine seismic surveys: Analysis and propagation of air-gun signals; and effects of air-gun exposure on humpback whales, sea turtles, fishes, and squid. Prepared for: Australian Petroleum Production and Exploration Association. 198 pp.

McClelland, J.W., A. Townsend-Small, R.M. Holmes, F. Pan, M. Stieglitz, M. Khosh, and B.J. Peterson. 2014. River export of nutrients and organic matter from the North Slope of Alaska to the Beaufort Sea. Water Resources Research, 50:1823-1839.

McCoy, M.A. and J.A. Salerno. 2010. Assessing the Effects of the Gulf of Mexico Oil Spill on Human Health: A Summary of the June 2010 Workshop (2010). Washington, D.C. The National Academies Press. Institute of Medicine.

McCrea-Strub et al. (McCrea-Strub, A., K. Kleisner, U.R. Sumaila, W. Swartz, R. Watson, D. Zeller, and D. Pauly). 2011. Potential impact of the *Deepwater Horizon* oil spill on commercial fisheries in the Gulf of Mexico. Fisheries 36(7):332-336.

McFarlin, K.M., R.C. Prince, R. Perkins, M.B. Leigh. 2014. Biodegradation of Dispersed Oil in Arctic Seawater at -1°C. PLoS ONE 9(1): e84297. doi:10.1371/journal.pone.0084297.

McGlade, C. and P. Ekins. 2015. The geographical distribution of fossil fuels unused when limiting global warming to 2°C. Nature 517(7533).

McKendrick, J. D. and W. W. Mitchell. 1978. Fertilizing and seeding oil-damaged Arctic tundra to effect vegetation recovery Prudhoe Bay, Alaska. Arctic. 31:296-304.

McLoughlin P.D., H.D. Cluff, and F. Messsier. 2002. Denning ecology of barren-ground grizzly bears in the central Arctic. Journal of Mammalogy 831:188-198.

McNutt, M., R. Camilli, G. Guthrie, P. Hsieh, V. Labson, B. Lehr, D. Maclay, A. Ratzel, and M. Sogge. 2011. Assessment of Flow Rate Estimates for the Deepwater Horizon/Macondo Well Oil Spill, Flow Rate Technical Group report to the National Incident Command, Interagency Solutions Group. MBAC (Microbiome Analysis Center). 2015. Gulf of Mexico SCHEMA: Shipwreck Corrosion, Hydrocarbon Exposure, Microbiology and Archaeology. George Mason University. Available online at http://www.osti.gov/scitech/servlets/purl/12354. Accessed August 25, 2015.

Meo, S.A., A.M. Al-Drees, I.M. Meo, M.M. Al-Saadi, M.A. Azeem. 2008. Lung Function in Subjects Exposed to Crude Oil Spill in Sea Water. Marine Pollution Bulletin 56(1):88–94.

Michel, J., A.C. Bejarano, C.H. Peterson, and C. Voss. 2013b. Review of biological and biophysical impacts from dredging and handling of offshore sand. U.S. Dept. of Interior, Bureau of Ocean Energy Management, Sterling, VA. OCS Study BOEM 2013-0119. 258 pp.

Mieszkowska, N, M.A. Kendall, S.J. Hawkins, R. Leaper, P. Williamson, N.J. Hardman-Mountford, A.J. Southward. 2006. Changes in the range of some common rocky shore species in Britain—a response to climate change? Hydrobiologia 555:241–251.

MIIS (Middlebury Institute of International Studies at Monterey). 2015. Market Data. National Ocean Economics Program. Available online at http://www.oceaneconomics.org/Market/ocean/oceanEcon.asp. Accessed September 2, 2015.

Millemann, D.R., R.J. Portier, G. Olson, C.S. Bentivegna, and K.R. Cooper. 2015. Particulate accumulations in the vital organs of wild *Brevoortia patronus* from the northern Gulf of Mexico after the Deepwater Horizon oil spill. Ecotoxicology: 1-17.

Miller, F.L. and A. Gunn. 1979. Responses of Peary caribou and muskoxen to turbo-helicopter harassment, Prince of Wales Island, Northwest Territories, 1976-77. Edmonton, AL,, Canada: Canadian Wildlife Service. Occasional Paper 40. 90 pp.

Miller, F.L. and A. Gunn. 1980. Behavioral-Responses of Muskox Herds to Simulation of Cargo Slinging by Helicopter, Northwest-Territories. Canadian Field-Naturalist, 94(1), pp.52-60.

Milton, S., P. Lutz, and G. Shigenaka. 2003. Oil toxicity and impact on sea turtles. In: Oil and sea turtles: Biology, planning, and response. Reprinted July 2010. Pp. 35-47. Available online at http://response.restoration.noaa.gov/sites/default/files/Oil_Sea_Turtles.pdf. Accessed September 8, 2016.

Mishra, D.R., H.J. Cho, S. Ghosh, A. Fox, C. Downs, P.B.T Merani, P. Kirui, N. Jackson, S. Mishra. 2012. Post-Spill State of the Marsh: Remote Estimation of the Ecological Impact of the Gulf of Mexico Oil Spill on Louisiana Salt Marshes. Remote Sensing of Environment, 118, 176-185.

Mississippi River/Gulf of Mexico Watershed Nutrient Task Force. 2008. Gulf Hypoxia Action Plan, 2008.

MMS (Minerals Management Service). 2002. Liberty Development and Production Plan, Final Environmental Impact Statement. OCS Report 2002-019. Alaska OCS Region, Anchorage, Alaska.

MMS. 2003. Cook Inlet Lease Sales 191 and 199, Final Environmental Impact Statement. Volume 1. OCS EIS/EA, MMS 2003-055.

MMS. 2005. Structure-Removal Operations on the Gulf of Mexico Outer Continental Shelf: Programmatic Environmental Assessment. U.S. Dept. of Interior, Minerals Management Service, Gulf of Mexico OCS Region, New Orleans, LA. OCS EIS/EA MMS 2005-013. 358pp.

MMS. 2006. MMS updates Hurricanes Katrina and Rita damage. Release #3486. May 1, 2006. Available online at http://www.boem.gov/boem-newsroom/press-releases/2006/press0501.aspx. Accessed December 14, 2015.

MMS. 2007. Chukchi Sea Planning Area Oil and Gas Lease Sale 193 and Seismic Surveying Activities in the Chukchi Sea. Final Environmental Impact Statement. U.S. Department of the Interior, Bureau of Ocean Energy Management, Alaska OCS Region, Anchorage, AK. OCS EIS/EA BOEM 2007-026.

MMS. 2009. Subsistence Mapping of Nuiqsut, Kaktovik, and Barrow. Anchorage AK, MMS Alaska OCS Region. MMS OCS Study Number 2009-003.

MMS. 2010. cANIMIDA Task 2 Hydrocarbon and Metal Characterization of Sediments in the cANIMIDA Study Area. OCS Study MMS 2010-004. 235 pp.

Moein, S.E., J.A. Musick, J.A. Keinath, D.E. Barnard, M.L. Lenhardt, and R. George. 1995. Evaluation of seismic sources for repelling sea turtles from hopper dredges, pp. 90-93. IN: L.Z. Hales (ed.), Sea Turtle Research Program: Summary Report. Technical Report CERC-95.

Montagna, P.A. and D.E. Harper, Jr. 1996. Benthic infauna long-term response to offshore production platforms in the Gulf of Mexico. Canadian Journal of Fisheries and Aquatic Sciences 53: 2567-2588.

Moore, S.F. and R.L. Dwyer. 1974. Effects of oil on marine organisms: a critical assessment of published data. Water Research 8:819-827.

Morang, A., J.P. Waters, and S.M. Khalil. 2012. Gulf of Mexico Regional Sediment Budget. Journal of Coastal Research: Special Issue 60: pp. 14-29.

Morrison, R.I.G., B.J. McCaffery, R.E. Gill, S.K. Skagen, S.L. Jones, G.W. Page, C.L. Gratto-Trevor, B.A. Andres. 2006. Population Estimates for North American Shorebirds, 2006. Wader Study Group Bulletin 111:67-85.

Morrison, R.I.G., R.E. Gill, Jr., B.A. Harrington, S. Skagen, G.W. Page, C.L. Gratto-Trevor, S.M. Haig. 2001. Estimates of shorebird populations in North America. Occasional Paper No. 104, Canadian Wildlife Service, Ottawa, Ontario. 64 pp.

Morton, R.A. 2007. Historical Changes in the Mississippi-Alabama Barrier Islands and the Roles of Extreme Storms, Sea Level, and Human Activities. Open-File Report 2007-1161. U.S. Geological Survey, Coastal and Marine Geology Program, St. Petersburg, FL. 38 pp.

Morton, R.A., T. Miller, and L. Moore. 2005. Historical shoreline changes along the U.S. 1001 Gulf of Mexico: A summary of recent shoreline comparisons and analyses. Journal of 1002 Coastal Research, Vol. 21(4): 704–709.

Mrosovsky, N., G.D. Ryan, and M.C. James. 2009. Leatherback turtles: The menace of plastic. Marine Pollution Bulletin 58(2):287-289.

Muhling, B.A., M.A. Roffer, J.T. Lamkin, G.W. Ingram, Jr., M.A. Upton, G. Gawlikowski, F. Muller-Karger, S. Habtes, W.J. Richards. 2012. Overlap between Atlantic Bluefin Tuna Spawning Grounds and Observed Deepwater Horizon Surface Oil in the Northern Gulf of Mexico. Marine Pollution Bulletin, 64, 679-687.

Muller-Karger, F.E., J.P. Smith, S. Werner, R. Chen, M. Roffer, Y. Liu, B. Muhling, D. Lindo-Atichati, J. Lamkin, S. Cerdeira-Estrada, D.B. Enfield. 2015. Natural Variability of Surface Oceanographic Conditions in the Offshore Gulf of Mexico. Progress in Oceanography, 134, 54-76.

Mullin, K.D. and W. Hoggard. 2000. Visual surveys of cetaceans and sea turtles from aircraft and ships, Chapter 4. IN: R.W. Davis, W.E. Evans, and B. Würsig (eds.). Cetaceans, Sea Turtles and Seabirds in the Northern Gulf of Mexico: Distribution, Abundance and Habitat Associations. Volume II: Technical Report. Prepared by Texas A&M University at Galveston and the National Marine Fisheries Service. U.S. Department of the Interior, U.S. Geological Survey, Biological Resources Division, USGS/BRD/CR-1999-005 and Minerals Management Service, Gulf of Mexico OCS Region, New Orleans, LA. OCS Study MMS 2000-003.

Mundy, C.J., M. Gosselin, J. Ehn, Y. Gratton, A. Rossnagel, D.G. Barber, J. Martin, J.-É. Trembley, M. Palmer, K.R. Arrigo, G. Darnis, L. Fortier, B. Else, and T. Papakyriakou. 2009. Contribution of under-ice primary production to an ice-edge upwelling phytoplankton bloom in the Canadian Beaufort Sea. Geophysical Research Letters 36(17): L17601. doi:10.1029/2009GL038837.

Murawski, S.A., W.T. Hogarth, E.B. Peebles, and L. Barbeiri. 2014. Prevalence of external skin lesions and polycyclic aromatic hydrocarbon concentrations in Gulf of Mexico fishes, post-Deepwater Horizon. Transactions of the American Fisheries Society 143(4):1084-1097.

Mustin, K., W.J. Sutherland, J.A. Gill. 2007. The complexity of predicting climate induced ecological impacts. Climate Research. 35, 165–175.

Muto, M.M., V.T. Helker, R.P. Angliss, B.A. Allen, P.L. Boveng, J.M. Breiwick, M.F. Cameron, P.J. Clapham, S.P. Dahle, M.E. Dahlheim, B.S. Fadely, M.C. Ferguson, L.W. Fritz, R.C. Hobbs, Y.V. Ivashchenko, A.S. Kennedy, J.M. London, S.A. Mizroch, R.R. Ream, E.L. Richmond, K.E.W. Shelden, R.G. Towell, P.R. Wade, J.M. Waite, and A.R. Zerbini. 2016. Alaska Marine Mammal Stock Assessments, 2015. June 2016. NOAA Technical Memorandum NMFS-AFSC-323. 300 p. doi:10.7289/V5/TM-AFSC-323.

NACBI (North American Bird Conservation Initiative, U.S. Committee). 2014. The state of the birds. 2014 Report. U.S. Department of the Interior. Washington DC. 16 pp.

NACBI. 2016. State of North America's Birds. U.S. Department of the Interior. Washington DC. 16 pp.

Naidu, A.S., J.J. Goering, J.J. Kelley and M.I. Venkatesan. 2001. Historical Changes in Trace Metals and Hydrocarbons in the Inner Shelf, Beaufort Sea: Prior and Subsequent to Petroleum-Related Industrial Developments. Final Report. OCS Study MMS 2001-061. University of Alaska Coastal Marine Institute, University of Alaska Fairbanks and USDOI, MMS, Alaska OCS Region. 80 p.

NASA (National Aeronautics and Space Administration). 2013. Final environmental impact statement sounding rockets program at Poker Flat Research Range. Wallops Island, VA: WFF Environmental Office.

National Atlas. 2013. Profile of the People and Land of the United States. Available online at http://nationalatlas.gov/articles/mapping/a_general.html. Accessed February 12, 2015.

National Commission (National Commission on the BP Deepwater Horizon Oil Spill and Offshore Drilling). 2011. Deep Water: The Gulf Oil Disaster and the Future of Offshore Drilling Report to the President. 381 pp.

Neff, J.M. 2005. Composition, Environmental Fates, and Biological Effects of Water-Based Drilling Muds and Cuttings Discharged to the Marine Environment: A Synthesis and Annotated Bibliography. Prepared for Petroleum Environmental Research Forum (PERF) and American Petroleum Institute. 83 pp.

Neff, J.M. 2010. Fates and Effects of Water Based Drilling Muds and Cuttings in Cold-Water Environments. Prepared for Shell Exploration and Production Company. Houston, Texas.

Neff, J.M., K. Lee, and E.M. DeBlois. 2011. Produced Water: Overview of Composition, Fates and Effects. Produced Water. Environmental Risks and Advances in Mitigation Technologies. New York, NY: Springer New York. pp.608.

Neff, J.M., S. McKelvie and R.C. Ayers, Jr. 2000. Environmental impacts of synthetic based drilling fluids. Report prepared for MMS by Robert Ayers & Associates, Inc. August 2000. Gulf of Mexico OCS Region, New Orleans, LA. OCS Study MMS 2000- 064. 118 pp.

NEI (Northern Economics, Inc). 2006. North Slope Economy, 1965–2005. April 2006. OCS Study MMS 2006-020. Available online at http://www.boem.gov/BOEM-Newsroom/Library/Publications/2006/2006_020.aspx. Accessed September 20, 2016.

NEI. 2014. Importance of Cook Inlet Oil and Gas to Southcentral Alaska.

Neilson, J.L., C.M. Gabriele, A.S. Jensen, K. Jackson, J.M. Straley. 2012. Summary of Reported Whale-Vessel Collisions in Alaskan Waters. Journal of Marine Biology. doi:10.1155/2012/106282.

Nesis, K.N. 2001. West-Arctic and East-Arctic distributional ranges of cephalopods. Sarsia 86(1): 1-11.

NIEHS (National Institute of Environmental Health Sciences). 2013. Mental Health Following the *Deepwater Horizon* Oil Spill. Appendix to Literature Summary and Review of Disaster Mental Health. NIEHS/WETP, Dec. 2013.

Ninilchik Traditional Council. 2013. Ninilchik Village Tribe and the Ninilchik Traditional Council. Available online at http://52.37.60.224/wp-content/uploads/Subsistence-Fish-lnfo-Newsletter.pdf. Accessed August 23, 2016.

NIPCC (Non-Governmental International Panel on Climate Change). 2013. Climate Change Reconsidered II: Physical Science. 2013 Report of the Nongovernmental International Panel on Climate Change (NIPCC). S.T. Karnick and Diane Carol Bast (eds.). The Heartland Institute, Chicago, IL. 993 pp.

NIPCC. 2014. Climate Change Reconsidered II: Biological Impacts. 2014 Report of the Nongovernmental International Panel on Climate Change (NIPCC). Diane Carol Bast and S.T. Karnick (eds.). The Heartland Institute, Chicago, IL.

NMFS (National Marine Fisheries Service). 2009. Final Amendment 1 to the 2006 Consolidated Atlantic Highly Migratory Species Fishery Management Plan, Essential Fish Habitat. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Office of Sustainable Fisheries, Highly Migratory Species Management Division, Silver Spring, MD. Public Document. pp. 395.

NMFS and USFWS. 2007a. Green sea turtle (*Chelonia mydas*) 5-year review: summary and evaluation. NMFS Office of Protected Resources, Silver Spring, MD and USFWS Southeast Region, Jacksonville, FL.

NMFS and USFWS. 2007b. Hawksbill sea turtle (*Eretmochelys imbricata*) 5-year review: summary and evaluation. 90 pages.

NMFS and USFWS. 2011. Recovery Plan for the U.S. Population of Atlantic Green Turtle (*Chelonia mydas*) October 1991. 59 pp. Accessed August 16, 2016

NMFS and USFWS. 2013. Hawksbill Sea Turtle (*Eretmochelys imbricata*) 5-year Review: Summary and Evaluation. June 2013. 92 pp. Accessed August 16, 2016.

NMFS and USFWS. 2015. Kemp’s Ridley Sea Turtle (*Lepidochelys kempii*) 5-year Review: Summary and Evaluation. Available online at http://www.nmfs.noaa.gov/pr/listing/final_july_2015_kemp_s_5_year_review.pdf. July 2015. 63 pp. Accessed August 9, 2016.

NMFS, USFWS, and SEMARNAT. 2010. Draft bi-national recovery plan for the Kemp’s ridley sea turtle (*Lepidochelys kempii*), second revision. National Marine Fisheries Service, Silver Spring, MD. 174 pp.

NMFS, USFWS, and SEMARNAT. 2011. Bi-National Recovery Plan for the Kemp’s Ridley Sea Turtle (*Lepidochelys kempii*), Second Revision. National Marine Fisheries Service. Silver Spring, Maryland 156 pp. + appendices.

NMFS. 2011. Bi-National Recovery Plan for the Kemp’s Ridley Sea Turtle (*Lepidochelys kempii*), Second Revision. Available online at http://www.nmfs.noaa.gov/pr/pdfs/recovery/turtle_kempsridley_draft2.pdf. Accessed September 14, 2016.

NMFS. 2013. Endangered Species Act (ESA) Section 7(a) (2) Biological Opinion, Oil and Gas Leasing and Exploration Activities in the U.S. Beaufort and Chukchi Seas, Alaska. NMFS F/AKR/2011/0647. 527 pp. Seattle, WA: USDOC, NOAA, NMFS, Alaska Fisheries.

NMFS. 2015a. Sea Turtles. Available online at http://www.nmfs.noaa.gov/pr/species/turtles/. Accessed September 24, 2015.

NMFS. 2015b. Fisheries of the United States, 2014. U.S. Department of Commerce, NOAA Current Fishery Statistics No.2014. Available online at: https://www.st.nmfs.noaa.gov/commercial-fisheries/fus/fus14/index. Accessed September 1, 2016.

NMFS. 2015c. Cetacean Assessment & Ecology Program, Aerial Surveys of Arctic Marine Mammals (ASAMM). 2015 Aerial Surveys. Available online at http://www.afsc.noaa.gov/NMML/cetacean/bwasp/index.php. Accessed November 9, 2015.

NMFS. 2016. Status of Stocks 2015: Annual Report to Congress on the Status of U.S. Fisheries. April 2016. Available online at http://www.nmfs.noaa.gov/sfa/publications/feature_stories/2016/status_of_stocks_2015.html.

NMFS. 2015d. Draft Recovery Plan for the Cook Inlet Beluga Whale (*Delphinapterus leucas*). National Marine Fisheries Service, Alaska Regional Office, Protected Resources Division, Juneau, AK.

NOAA and MCBI. 2000. Anthropogenic Noise in the Marine Environment – Potential Impacts on the Marine Resources of Stellwagen Bank and Channel Islands National Marine Sanctuaries. Prepared by Conservation and Development Problem Solving Team, University of Maryland, College Park, MD. 95 pp.

NOAA Fisheries. 2015. Distribution and Relative Abundance of Marine Mammals in the Eastern Chukchi and Western Beaufort Seas, 2014. Prepared by NOAA Fisheries, National Marine Mammal Laboratory. OCS Study BOEM 2015-040. September 2015.

NOAA Fisheries. 2016. Cook Inlet Beluga Whales. Available online at https://alaskafisheries.noaa.gov/pr/ci-belugas. Accessed 20 July 2016.

NOAA Ocean Explorer. 2010. Types of offshore oil and gas structures. Available online at http://oceanexplorer.noaa.gov/explorations/06mexico/background/oil/media/types_600.html. Accessed September 12, 2016.

NOAA Office of National Marine Sanctuaries. 2016. Flower Garden Banks National Marine Sanctuary Expansion Draft Environmental Impact Statement. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, Office of National Marine Sanctuaries, Silver Spring, Maryland.

NOAA. 1994. Shoreline Countermeasures Manual, Alaska, NOAA Hazardous Materials Response and Assessment Division. Available online at http://response.restoration.noaa.gov/sites/default/files/shoreline_countermeasures_alaska.pdf. Accessed September 1, 2016.

NOAA. 2002. Cook Inlet and Kenai Peninsula, Alaska. Environmentally Sensitive Areas: Winter (December – March). Available online at http://www.asgdc.state.ak.us/maps/cplans/cook/PDFS/WINTER.PDF. Accessed August 2016.

NOAA. 2010. Characteristic Coastal Habitats: Choosing Spill Response Alternatives, National Ocean Service, Office of Response and Restoration, Hazardous Materials Response Division. Available online at http://response.restoration.noaa.gov/sites/default/files/Characteristic_Coastal_Habitats.pdf. Accessed September 14, 2016.

NOAA. 2011. The Gulf of Mexico at a Glance: A Second Glance. 51 pp. Available online at http://stateofthecoast.noaa.gov/NOAAs_Gulf_of_Mexico_at_a_Glance_report.pdf.

NOAA. 2012. Gulf of Mexico Activities Report. 2012. Office of Coast Surveys, Center for Operational Oceanographic Products & Services. National Geodetic Survey.

NOAA. 2013a. Elkhorn Coral (*Acropora palmata*). Available online at http://www.nmfs.noaa.gov/pr/species/invertebrates/elkhorncoral.htm. Accessed 21 September 2015.

NOAA. 2013b. Staghorn Coral (*Acropora cervicornis*). Available online at http://www.nmfs.noaa.gov/pr/species/invertebrates/staghorncoral.htm. Accessed 21 September 2015.

NOAA. 2013c. NOAA's State of the Coast; National Population Report – Population Trends from 1970 to 2020. Available online at http://stateofthecoast.noaa.gov. Accessed 1 July 2016.

NOAA. 2016b. Fisheries Economics of the United States, 2014: Economics and Sociocultural Status and Trends Series. US Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service. NOAA Technical Memorandum NMFS-F/SPO-163. May 2016.

NOAA. 2016c. Guidance and Procedures for the Baseline Environmental Survey for Marine Aquaculture Activities in U.S. Federal Waters of the Gulf of Mexico. Southeast Regional Office, National Marine Fisheries Service. Available online at http://sero.nmfs.noaa.gov/sustainable_fisheries/gulf_fisheries/aquaculture/documents/pdfs/baseline_enviromental_survey_guidance.pdf. Accessed August 16, 2016.

NOAA. 2016a. Commercial Fisheries Statistics, Annual Commercial Landing Statistics. NOAA Office of Science and Technology, National Marine Fisheries Service. Available online at : https://www.st.nmfs.noaa.gov/commercial-fisheries/commercial-landings/annual-landings/index. Accessed October 11, 2016.

Norman, E.S.; G. Dunn, K. Bakker, D.M. Allen, and R. Cavalcanti de Albuquerque. 2013. Water security assessment: Integrating governance and freshwater indicators. Water Resources Management 27(2): 535-551.

Normandeau and Associates, Inc. 2012. Effects of noise on fish, fisheries, and invertebrates in the U.S. Atlantic and Arctic from energy industry sound-generating activities. Workshop Report U.S. Department of the Interior, Bureau of Ocean Energy Management. Contract No. M11PC00031. 361 pp.

Norris F.H., M.J. VanLandingham, and L. Vu. 2009. PTSD in Vietnamese Americans following Hurricane Katrina: Prevalence, patterns, and predictors. Journal of Traumatic Stress. 22:91–101.

NPFMC (North Pacific Fishery Management Council). 2009. Fishery management plan for fish resources of the Arctic Management Area. North Pacific Fishery Management Council. Anchorage AK. 146 pp. Internet website: http://www.npfmc.org/wp-content/PDFdocuments/fmp/Arctic/ArcticFMP.pdf.

NPFMC et al. 2012. Fishery management plan for the salmon fisheries in the EEZ off Alaska. North Pacific Fishery Management Council. Anchorage AK. 59 pp. http://www.npfmc.org/wp-content/PDFdocuments/fmp/Salmon/SalmonFMPfinal1212.pdf. Accessed August 19, 2016.

NPFMC, NMFS, and Alaska Department of Fish and Game. 2012. Fishery Management plan for the salmon fisheries in the EEZ off Alaska North Pacific Management Council, Anchorage Ak, 59 pp + apps.

NPFMC. 2014. Fishery Management Plan for the scallop fishery off Alaska. North Pacific Management Council, Anchorage AK. 52 pp +apps.

NPFMC. 2015. Fishery management plan for groundfish of the Gulf of Alaska. North Pacific Fishery Management Council. Anchorage AK. 130 pp. Available online at http://www.npfmc.org/wp-content/PDFdocuments/fmp/GOA/GOAfmp.pdf. Accessed September 1, 2016.

NPS. 2010. Federal Land Managers' Air Quality Related Values Work Group (FLAG), Phase I Report – Revised. Available online at http://www.nature.nps.gov/air/Pubs/pdf/flag/FLAG_2010.pdf. Accessed August 3, 2016.

NPS. 2011. Gulf Islands National Seashore Draft Management Plan/Environmental Impact Statement, p. 34. Available online at https://parkplanning.nps.gov/document.cfm?parkID=384&projectID=11318&documentID=43031. Accessed September 8, 2016.

NRC (National Research Council). 1983. Drilling Discharges in the Marine Environment, Panel on Assessment of Fates and Effects of Drilling Fluids and Cuttings in the Marine Environment. Marine Board, Commission on Engineering and Technical Systems. National Academies Press, Washington, D.C.

NRC. 2003a. Oil in the Sea III: Inputs, Fates, and Effects, Committee on Oil in the Sea: Inputs, Fates, and Effects. Ocean Studies Board and Marine Board, Divisions of Earth and Life Studies and Transportation Research Board. National Academies Press, Washington, D.C.

NRC. 2003b. Cumulative Environmental Effects of Oil and Gas Activities on Alaska's North Slope. National Academies Press, Washington, D.C.

NRC. 2011. National Security Implications of Climate Change for U.S. Naval Forces. Washington DC, National Academies Press.

NRC. 2014. Report in brief: Responding to oil spills in the U.S. Arctic marine environment. April 2014. 8 pp. Available online at http://dels.nas.edu/resources/static-assets/materials-based-on-reports/reports-in-brief/Arctic-Oil-Spill-Brief-Final02.pdf. Accessed September 14, 2016.

NSB (North Slope Borough). 2005a. North Slope Borough: Atqasuk Village Profile. Available online at http://www.north-slope.org/assets/images/uploads/AtqasukVillageProfile06.pdf. Accessed September 14, 2016.

NSB. 2005b. North Slope Borough: Point Lay Village Profile. Available online at http://www.north-slope.org/assets/images/uploads/PtLayVillageProfile06.pdf. Accessed September 14, 2016.

NSB. 2011a. North Slope Borough: Economic Profile and Census Report 2010. Available online at http://www.north-slope.org/assets/images/uploads/North_Slope_Borough.pdf. Accessed November 7, 2015.

NSB. 2011b. Estimates of Subsistence Harvest for Villages of the North Slope of Alaska, 1994-2003.

NSB. 2012. Baseline Community Health Analysis Report: A Report on Health and Wellbeing. Iluagniagnikkun Qaisaksrat. North Slope Borough, Department of Health and Social Services. July 2012. Available online at http://www.north-slope.org/assets/images/uploads/BaselineCommunityHealthAnalysisReport.pdf. Accessed August 20, 2016.

NSB. 2014a. Health Indicators in the North Slope Borough Monitoring the Effects of Resource Development Projects. Available online at http://www.north-slope.org/assets/images/uploads/NSB_Indicators_Report_August_4_printable_FINAL.pdf. Accessed August 25, 2016.

NSB. 2014b. Kaktovik Comprehensive Development Plan. Department of Planning and Community Services. North Slope Borough, Dec. 2014. Available online at http://www.north-slope.org/assets/images/uploads/Kaktovik_December_Final_Draft.pdf. Accessed August 20, 2016.

NSB. 2014c. Soaring to the Future 2014–2025: Barrow Comprehensive Plan. Prepared by Community Planning Division, North Slope Borough Department of Planning and Community Services. 271 pp. Available online at http://www.north- slope.org/assets/images/uploads/reduced_size_Barrow_Comp_Plan_FINAL_DRAFT_(1).pdf. Accessed August 20, 2016.

NSB. 2014d. Wainwright Comprehensive Development Plan. Department of Planning and Community Services. North Slope Borough, Feb. 2014. Available online at http://www.north-slope.org/assets/images/uploads/Wainwright_Comp_Plan_Final_Approved_6.03.2014.pdf. Accessed August 20, 2016.

NSB. 2015a. Health Impact Assessment in the NSB: A Guide for Stakeholders, Decision-makers and Project Proponents.

NSB. 2015b. Soaring to the Future: Barrow Comprehensive Plan, 2015–2035. Available online at http://www.north-slope.org/assets/images/uploads/Barrow_Comp_Plan_March_2015_FINAL.pdf. Accessed September 14, 2016.

NSB. 2015c. Kaktovik Comprehensive Plan. April 2015. Available online at http://www.north-slope.org/assets/images/uploads/KAK_Comp_Plan_April_2015_Final.pdf. Accessed September 14, 2016.

NSB. 2015d. Nuisqut Draft Comprehensive Development Plan. Available online at http://www.north-slope.org/assets/images/uploads/NUI_Public_Review_Draft_Reduced_Size.pdf. Accessed September 14, 2016.

NSB. 2016a. 2016–2036 Anaktuvuk Pass Comprehensive Development Plan. May 2016. Available online at http://www.north-slope.org/assets/images/uploads/AKP_Public_Review_Draft_04252016_Reduced_Size.pdf. Accessed September 14, 2016.

NSB. 2016b. 2016–2036 Point Hope Comprehensive Plan. Available online at http://www.north-slope.org/assets/images/uploads/PHO_plan_08022016_Public_Review_Draft.pdf. Accessed September 14, 2016.

NSB. 2016c. North Slope Borough Comprehensive Plan Development. July 2016. Available online at http://www.north-slope.org/your-government/comprehensive-plan. Accessed August 19, 2016.

Nuka Research and Planning Group, LLC and Pearson Consulting. 2010. Oil spill prevention and response in the U.S. Arctic Ocean: Unexamined risks, unacceptable consequences. Report to Pew Environment Group. http://www.pewenvironment.org/uploadedFiles/PEG/Publications/Report/Oil Spill Prevention.pdf

Nunny, R., E. Graham, and S. Bass. 2008. Do Sea Turtles use Acoustic Cues when Nesting? NOAA Technical Memorandum NMFS SEFSC No. 582: 83.

Nuttall, M. 2012. Tipping points and the human world: living with change and thinking about the future. AMBIO 41(1):96–105.

NWAB (Northwest Arctic Borough). 2016. Subsistence Mapping Project: Documenting Our Way of Life through Maps. Available online at http://www.nwabor.org/wp-content/uploads/1-Cover-and-Front-Matter.pdf. Accessed August 1, 2016.

Obenour, D.R., D. Scavia, N.N. Rabalais, R.E. Turner, and A.M. Michalak. 2013. Retrospective analysis of midsummer hypoxic area and volume in the northern Gulf of Mexico, 1985-2011. Environmental Science & Technology 47:9808-9815.

Office of the Press Secretary. 2015. Presidential Memorandum – Withdrawal of Certain Areas of the United States Outer Continental Shelf Offshore Alaska from Leasing Disposition. Memorandum for the Secretary of the Interior, January 27, 2015. Available online at https://www.whitehouse.gov/the-press-office/2015/01/27/presidential-memorandum-withdrawal-certain-areas-united-states-outer-con. Accessed July 17, 2016.

Orr, J.C., V.J. Fabry, O. Aumont, L. Bopp, S.C. Doney, R.A. Feely, A. Gnanadesikan, N. Gruber, A. Ishida, F. Joos, R.M. Key, K. Lindsay, E. Maier-Reimer, R. Matear, P. Monfray, A. Mouchet, R.G. Najjar, G-K. Plattner, K.B. Rodgers, C.L. Sabine, J.L. Sarmiento, R. Schlitzer, R.D. Slater, I.J. Totterdell, M-F. Weirig, Y. Yamanaka, and A. Yool. 2005. Anthropogenic Ocean Acidification Over the Twenty-First Century and its Impact on Calcifying Organisms. Nature 437:681-686.

OSAT (Operational Science Advisory Team). 2010. Summary Report for Sub-sea and Sub-surface Oil and Dispersant Testing: Sampling and Monitoring. 131 pp.

Osofsky, H.M., K. Baxter-Kauf, B. Hammer, A. Mailander, B. Mares, A. Pikovsky, A. Whitney, L. Wilson. 2011. Environmental Justice and the BP *Deepwater Horizon* Oil Spill. New York University Environmental Law Journal. Volume 20, Issue 1.

Otvos, E.G. and G.A. Carter. 2008. Hurricane Degradation – Barrier Development Cycles, Northeastern Gulf of Mexico: Landform Evolution and Island Chain History. Journal of Coastal Research 24(2):463-478.

Oxford Economics. 2010. Potential Impact of the Gulf Oil Spill on Tourism. 24 pp. Available online at https://www.ustravel.org/sites/default/files/page/2009/11/Gulf_Oil_Spill_Analysis_Oxford_Economics_710.pdf.

Paine, J.G., T. Caudle, and J. Andrews. 2014. Historical to recent Texas Gulf shoreline movement and its postglacial context. 2014 Geological Society of America (GSA) Annual Meeting in Vancouver, British Columbia (19-22 October 2014).

Palaneasu-Lovejoy, M.; Kranenburg, C.; Barras, J.A., and Brock, J.C. 2013. Land loss due to recent hurricanes in coastal Louisiana, U.S.A. In: Brock, J.C.; Barras, J.A., and Williams, S.J. (eds.), Understanding and Predicting Change in the Coastal Ecosystems of the Northern Gulf of Mexico, Journal of Coastal Research, Special Issue No. 63, pp. 97–109, Coconut Creek (Florida), ISSN 0749-0208.

Paleczny M., E. Hammill, V. Karpouzi, and D. Pauly. 2015. Population Trend of the World's Monitored Seabirds, 1950-2010. PLoS ONE 10(6): e0129342. doi:10.1371/journal.pone.0129342.

Parr, A.E. 1939. Quantitative observations on pelagic *Sargassum* vegetation of the western North Atlantic. Bulletin of the Bingham Oceanographic Collection. 6:1-94.

Passow, U., K. Ziervogel, V. Asper, and A. Diercks. 2012. Marine snow formation in the aftermath of the Deepwater Horizon oil spill in the Gulf of Mexico. Environmental Research Letters, 7(3), 035301.

Paul, J.H., D. Hollander, P. Coble, K.L. Daly, S. Murasko, D. English, J. Basso, J. Delaney, L. McDaniel, and C.W. Kovach. 2013. Toxicity and mutagenicity of Gulf of Mexico waters during and after the Deepwater Horizon oil spill. Environmental Science & Technology 47(17):9651-9659.

Payne, J.R., G.D. McNabb Jr., and J.R. Clayton Jr. 1991. Oil weathering behavior in Arctic environments. Pp. 631-662 IN: Sakshaug, E., C.C.E. Hopkins, and N.A. Britsland (eds.): Proceedings of the Pro Mare Symposium on Polar Marine Ecology. Trondheim. 12-16 May 1990. Polar Research lO(2).

Peres, Lauren C., Edward Trapido, Ariane L. Rung, Daniel J. Harrington, Evrim Oral, Zhide Fang, Elizabeth Fontham, and Edward S. Peters. 2015. Deepwater Horizon Oil Spill and Physical Health among Adult Women in Southern Louisiana: The Women and Their Children's Health (WaTCH) Study. Environmental Health Perspectives. doi: 10.1289/ehp.1510348. Available online at http://sph.lsuhsc.edu/research-watch. Accessed August 25, 2016.

Pew Charitable Trusts. 2013. Arctic Standards: Recommendations on Oil Spill Prevention, Response, and Safety in the U.S. Arctic Ocean. 142 pp.

Pezeshki, S.R. and R.D. DeLaune. 2015. United States Gulf of Mexico Coastal Marsh Vegetation Responses and Sensitivities to Oil Spill: A Review. Environments 2:586-607.

Philippart, C.J.M., H.M. Van Aken, J.J. Beukema, O.G. Bos, G.C. Cadee´, and R. Dekker. 2003. Climate-related changes in recruitment of the bivalve *Macoma balthica*. Limnology and Oceanography 48: 2171–2185.

Picou, J.S. and C. Arata. 1997. Chronic Psychological Impacts of the Exxon Valdez Oil Spill: Resource Loss and Commercial Fishers. Appendix J in Coping with Technological Disasters: A User Friendly Guidebook, Prince William Sound Regional Citizens' Advisory Council, Anchorage, Alaska.

Picou, J.S., D.A. Gill, C.L. Dyer, and E.W. Curry. 1990. Social disruption and psychological stress in an Alaskan fishing community: The impact of the *Exxon Valdez* oil spill. Presentation to the Southern Sociological Society Annual Meeting, Louisville, Kentucky. March 23 1990.

Picou, S. 2010. Helping Others: A Community Peer Listener Training Program. Training session presented at Louisiana State University, Baton Rouge, La., July 28.

Pine, J. 2006. Hurricane Katrina and Oil Spills: Impact on Coastal and Ocean Environments. Oceanography 19: 37-39.

PND Engineers. 2012. West Dock Causeway Breach. Anchorage Alaska. Available online at http://www.pndengineers.com/Modules/ShowDocument.aspx?documentid=581. Accessed June 27, 2016.

Poppel, B., J. Kruse, G. Duhaime, and L. Abryutina. 2007. Survey of Living Conditions in the Arctic. Results. Anchorage, AK: University of Alaska, Anchorage, Institute for Social and Economic Research.

Popper, A.N., A.D. Hawkins, R.R. Fay, D. Mann, S. Bartol, T. Carlson, S. Coombs, W.T. Ellison, R. Gentry, M.B. Halvorsen, S. Lokkeborg, P. Rogers, B.L. Southall, D.G. Zeddies, W.N. Tavolga. 2014. Sound Exposure Guidelines for Fish and Sea Turtles: A Technical Report. Prepared by ANSI-Accredited Standards Committee.

Port of Anchorage. 2015. Port of Anchorage. Available online at http://www.portofanc.com/. Accessed June 22, 2016.

Poulin, M., N. Daugbjerg, R. Gradinger, L. Ilyash, T. Ratkova, and C. von Quillfeldt. 2011. The Pan-Arctic Biodiversity of Marine Pelagic and Sea-Ice Unicellular Eukaryotes: A First-Attempt Assessment. Marine Biodiversity 41: 13-28.

Powell, E.N. 1995. Evidence for temporal change at seeps. In: MacDonald, I.R., W.W. Schroeder, and J.M. Brooks, eds. 1995. Chemosynthetic ecosystems study: Final report. Volume 2: Technical report. U.S. Department of the Interior, Minerals Management Service, Gulf of Mexico OCS Region, New Orleans, LA. OCS Study MMS 95-0022. pp. 8.1-8.65.

Powers, S.P., F. Hernandez, R.H. Condon, J.M. Drymon, and C.M. Free. 2013. Novel Pathways for Injury from Offshore Oil Spills: Direct, Sublethal and Indirect Effects of the Deepwater Horizon Oil Spill on Pelagic *Sargassum* Communities. PLoS ONE 8(9): e74802. doi:10.1371/journal.pone.0074802.

Quakenbush, L., J.J. Citta, and J.C. George. 2012. Seasonal movements of the Bering-Chukchi-Beaufort stock of bowhead whales: 2006-2011 satellite telemetry results. International Whaling Commission Science Committee Report SC/64/BRG1. 22 pp.

Quakenbush, L.T. and Henry P. Huntington. 2010. Traditional Knowledge Regarding Bowhead Whales in the Chukchi Sea near Wainwright, Alaska. Coastal Marine Institute, University of Alaska Fairbanks.

Quest Offshore Resources, Inc. 2011. United States Gulf of Mexico Oil and Natural Gas Industry Impact Analysis. Available online at http://www.api.org/~/media/files/policy/jobs/questgomeconomicanalysis7-11-2011.pdf. Accessed August 25, 2016.

Questel, J.M., C. Clarke and R.R. Hopcroft. 2013. Seasonal and interannual variation in the planktonic communities of the northeastern Chukchi Sea during the summer and early fall. Continental Shelf Research 67:23–41.

Quinlan, S.E. and W.A. Lehnhausen. 1982. Arctic Fox, *Alopex lagopus,* predation on nesting Common Eiders, *Somateria mollissma,* at Icy Cape, Alaska. Canadian Field Naturalist 964:462-466.

Rabalais, N. N., R. E. Turner and W. J. Wiseman. 2002. Gulf of Mexico Hypoxia, aka “The Dead Zone.” Annual Review of Ecology and Systematics 33: 235-263.

Rabalais, N.N., B.A. McKee, D.J. Reed, and J.C. Means. 1991. Fate and Effects of Nearshore Discharges of OCS Produced Waters, Volume II: Technical Report. OCS Study MMS 91-0005, MMS, Gulf of Mexico OCS Region, New Orleans, LA. 359 pp.

Raveling, D.G. 1989. Nest-Predation Rates in Relation to Colony Size of Black Brant. Journal of Wildlife Management 531:87-90.

Raynolds, M.K, D.A. Walker, K.J. Ambrosius, J. Brown, K.R. Everett, M.Kanevskiy, G.P. Kofinas, V.E. Romanovsky, Y. Shur, P.J. Webber. 2014. Cumulative geoecological effects of 62 years of infrastructure and climate change in ice-rich permafrost landscapes, Prudhoe Bay Oilfield, Alaska. Global Change Biology. Volume 20, Issue 4, pp. 1211-1224.

Raynolds, M.K., D.A. Walker, and H.A. Maier. 2006. Alaska Arctic Tundra Vegetation Map. Scale 1:4,000,000. Conservation of Arctic Flora and Fauna (CAFF) Map No. 2. U.S. Fish and Wildlife Service, Anchorage, Alaska.

Reddy, C.M., J.S. Arey, J.S. Seewald, S.P. Sylva, K.L. Lemkau, R.K. Nelson, C.A. Carmichael, C. McIntyre, J. Fenwick, G.T. Ventura, B.A.S. Van Mooy, and R. Camilli. 2012. Composition and fate of gas and oil released to the water column during the Deepwater Horizon oil spill. Proceedings of the National Academy of Sciences 109:20229-20234.

Reynolds, P.E. 1992. Seasonal differences in the distribution and movements of muskoxen (*Ovibos moschatus*) in Northeastern Alaska. Rangifer 123:171-172.

Reynolds, P.E. 1998. Ecology of a reestablished population of muskoxen in northeastern Alaska. Ph.D Dissertation. Fairbanks, AK: University of Alaska.

Rezak, R., S.R. Gittings, and T.J. Bright. 1990. Biotic assemblages and ecological controls on reefs and banks of the northwest Gulf of Mexico. American Zoologist 30:23-35.

Rezak, R., T.J. Bright, and D.W. McGrail. 1983. Reefs and banks of the northwestern Gulf of Mexico: Their geological, biological, and physical dynamics. Final Technical Report No. 83-1-T.

Richardson, W. John, Bernd Wursig, and Charles Greene Jr. 1990. Reactions of bowhead whales, *Balaena mysticetus*, to drilling and dredging noise in the Canadian Beaufort Sea. Marine Environmental Research, Vol 29(2). Pp. 135-160.

Richardson, W.J., C.R. Greene Jr., C.I. Malme, and D.H. Thomson. 1995. Marine Mammals and Noise, Academic Press, San Diego, Calif.

Robertston, T.L., Campbell, L. K., Pearson, L., and Higman, B. 2013. Oil spill occurrence rates for Alaska North Slope crude and refined oil spills. Prepared by Nuka Research & Planning Group, LLC. OCS Study, BOEM 2013-205. Seldovia, AK: USDOI, BOEM Alaska OCS Region.

Rogers, C.S. 1990. Responses of coral reefs and reef organisms to sedimentation. Marine Ecology Progress Series. 62: 185-202.

Rooker, J.R., L.L. Kitchens, M.A. Dance, R.J.D. Wells, B. Falterman, M. Cornic. 2013. Spatial, Temporal, and Habitat-Related Variation in Abundance of Pelagic Fishes in the Gulf of Mexico: Potential Implications of the Deepwater Horizon Oil Spill. PLOS One 8(10): e76080. doi:10.1371/journal.pone.0076080.

Russell, R.W. 2005. Interactions between Migrating Birds and Offshore Oil and Gas Platforms in the Northern Gulf of Mexico: Final Report. U.S. Department of the Interior, Minerals Management Service, Gulf of Mexico OCS Region, New Orleans, LA. OCS Study MMS 2005-009. 348 pp.

Ruthrauff, D.R., T.L. Tibbitts, R.E. Gill, Jr., M.N. Dementyev, and C.M. Handel. 2012. Small Population Size of the Pribilof Rock Sandpiper Confirmed through Distance-Sampling Surveys in Alaska. The Condor 114(3): 544-551.

SAFMC (South Atlantic Fishery Management Council). 2009. Fishery Ecosystem Plan of the South Atlantic Region. Volume I: Introduction and Overview. Charleston, SC. April 2009.

Saint-Arnaud, D., P. Pelletier, W. Poe, and J. Fowler. 2004. Oil platform removal using engineered explosive charges: In-situ comparison of engineered and bulk explosive charges – final report. U.S. Dept. of the Interior, Minerals Management Service, Technology Assessment and Research (TAR) Program, Herndon, VA. [TAR Project No. 429].

Sammarco, P.W., S.R. Kolian, R.A.F. Warby, J.L. Bouldin, W.A. Subra and S.A. Porter. 2013. Distribution and Concentrations of Petroleum Hydrocarbons associated with the BP/Deepwater Horizon Oil Spill, Gulf of Mexico. Marine Pollution Bulletin 73(1):129-143.

Saupe, S.M., J. Gendron, and D. Dasher. 2005. The Condition of Southcentral Alaska Coastal Bays and Estuaries. A Statistical Summary for the National Coastal Assessment Program Alaska Department of Environmental Conservation. March 15, 2006. 136 pp.

Schonberg, S.V., J.T. Clarke, and K.H. Dunton. 2014. Distribution, Abundance, Biomass and Diversity of Benthic Infauna in the Northeast Chukchi Sea, Alaska: Relation to Environmental Variables and Marine Mammals. Deep Sea Research Part II: Topical Studies in Oceanography 102: 144-163.

Shaver, D.J., K.M. Hart, I. Fujisaki, C. Rubio, A.R. Sartain, J. Pena, P.M. Burchfield, D.G. Gamez, and J. Ortiz. 2013. Foraging Area Fidelity for Kemp's Ridleys in the Gulf of Mexico. Ecology and Evolution 3(7):2002-2012. Doi:10.1002/ece3.594.

Shedd, W., P. Godfriaux, K. Kramer, and J. Hunt. 2012. Seismic water bottom anomalies. U.S. Department of the Interior, Bureau of Ocean Energy Management, Gulf of Mexico OCS Region, Office of Resource Evaluation, Regional Analysis Unit, New Orleans, LA.

Shepard, R. and A. Rode. 1996. *The Health Consequences of Modernization: Evidence from Circumpolar Peoples.* Cambridge, UK: Cambridge University Press.

Shideler R. and J. Hechtel. 2000. Grizzly bear. In: The natural history of an arctic oil field development and the biota, J.C. Truett and S.R. Johnson, eds. San Diego, CA: Academic Press, 105-132 pp.

Shideler, R. 2006a. Email dated July 6, 2006, from R. Shideler, State of Alaska, Department of Fish and Game, to J. Wilder, Wildlife Biologist, MMS Alaska OCS Region; subject: muskoxen on the North Slope.

Shideler, R. 2006b. Email dated July 7, 2006, from R. Shideler, State of Alaska, Department of Fish and Game, to J. Wilder, Wildlife Biologist, MMS Alaska OCS Region; subject: grizzly bears on the North Slope.

Shigenaka, G., S. Milton, P. Lutz, R. Hoff, R. Yender, and A. Mearns. 2010. Oil and Sea Turtles: Biology, Planning and Response. 111 pp.

Shoop, C.R. and R.D. Kenney. 1992. Seasonal distributions and abundances of loggerhead and leatherback sea turtles in waters of the northeastern United States. Herpetological Monographs 6:43-67.

Sigler, M.F., M. Renner, S.L. Danielson, L.B. Eisner, R.R. Lauth, K.J. Kuletz, E.A. Logerwell and G.L. Hunt, Jr. 2011. Fluxes, fins, and feathers: Relationships among the Bering, Chukchi, and Beaufort seas in a time of climate change. Oceanography. 24(3), 250-265.

Silliman, B.R., J. van de Koppel, M.W. McCoy, J. Diller, G.N. Kasozi, K. Earl, P.N. Adams, A.R. Zimmerman. 2012. Degradation and resilience in Louisiana salt marshes after the BP–Deepwater Horizon oil spill. Proceedings of the National Academy of Sciences. 109(28):11234–11239. doi: 10.1073/pnas.1204922109.

Simpson, S.D., S. Jennings, M. P. Johnson, J. L. Blanchard, P. Schon, D. W. Sims, and M. J. Genner. 2011. Continental Shelf-Wide Response of a Fish Assemblage to Rapid Warming of the Sea. Current Biology 21: 1565-1570.

Širović, A., and L.S. Kendall. 2009. Passive acoustic monitoring of Cook Inlet beluga whales: Analysis report, Port of Anchorage Marine Terminal Redevelopment Project. Prepared for U.S. Department of Transportation, Maritime Administration, Washington, D.C.; Port of Anchorage, Anchorage; and Integrated Concepts and Research Corporation, Anchorage.

Sjare, B.L., and T.G. Smith. 1986a. The vocal repertoire of white whales, *Delphinapterus leucas*, summering in Cunningham Inlet, Northwest Territories. Canadian Journal of Zoology 64:407-415.

Sjare, B.L., and T.G. Smith. 1986b. The relationship between behavioral activity and underwater vocalizations of the white whale, *Delphinapterus leucas*. Canadian Journal of Zoology 64:2824-2831.

Small, B., M. Castellote, M. Lammers, J. Jenniges, A. Rosinski, S. Atkinson, C. Garner, and S. Moore. 2011. Seasonal distribution of Cook Inlet beluga whales based on passive acoustic monitoring. Presented at the 2011 Alaska Marine Science Symposium, Anchorage, AK.

Smith, T.E. 1989. The status of muskoxen in Alaska. In: Proceedings of the second international muskoxen symposium, P.F. Flood, ed. Saskatoon, Sask., Oct. 1-4, 1987. Ottawa, Ont., Canada: National Research Council of Canada, 350 pp.

Smith, W.T. and R.D. Cameron. 1985. Reactions of large groups of caribou to a pipeline corridor on the Arctic Coastal Plain of Alaska. Arctic: 53-57.

Snyder, S.M., E.L. Pulster, D.L. Wetzel, and S.A. Murawski. 2015. PAH exposure in Gulf of Mexico demersal fishes, post-Deepwater Horizon. Environmental Science and Technology 49(14): 8786-8795.

Solomon, S.D., M. Qin, Z. Chen, M. Marquis, K.B. Averyt, M. Tignor, H.L. Miller, eds. 2007. Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge University Press, Cambridge, United Kingdom, and New York, New York.

Southward, A.J., O. Langmead, N.J. Hardman-Mountford, J. Aiken, G.T. Boalch, P.R. Dando, M.J. Genner, I. Joint, M. Kendall, N.C. Halliday, R.P. Harris, R. Leaper, N. Mieszkowska, R.D. Pingree, A.J. Richardson, D.W. Sims, T. Smith, A.W. Walne, and S.J Hawkins. 2004. Long-term oceanographic and ecological research in the Western English Channel. Advances in Marine Biology 47: 1–105.

Speckman, S.G., J.F. Piatt, C.V. Minte-Vera, and J.K. Parrish. 2005. Parallel structure among environmental gradients and three trophic levels in a subartic estuary. Progress in Oceanography 66: 25-65.

Spier, C., W.T. Stringfellow, T.C. Hazen, and M. Conrad. 2013. Distribution of hydrocarbons released during the 2010 MC252 oil spill in deep offshore waters. Environmental Pollution 173:224-230.

Stafford, K.M., M.C. Ferguson, D.D.W. Hauser, S.R. Okkonen, C.L. Berchok, J.J. Citta, E.C. Garland, J. Jones, and R.S. Suydam. In review. Beluga whales in the Alaskan Beaufort Sea: a synthesis of available information on timing, distribution, habitat use and environmental drivers.

Stedman, S.M. and T.E. Dahl. 2008. Status and trends of wetlands in the coastal watersheds of the eastern United States, 1998 to 2004. 32 pp.

Stephen R. Braund and Associates. 2009. Impacts and Benefits of Oil and Gas Development to Barrow, Nuiqsut, Wainwright, and Atqasuk Harvesters.

Stephen R. Braund and Associates. 2010. Subsistence Mapping of Nuisquit, Kaktovik, and Barrow. OCS Study, MMS-2009-003. Anchorage, AK: USDOI, MMS Alaska OCS Region.

Stephen R. Braund and Associates. 2013. COMIDA: Impact Monitoring for Offshore Subsistence Hunting, Wainwright and Point Lay. OCS Study BOEM 2013-211.

Stickney, A.A., T. Obritschkewitsch, and R.M. Burgess. 2014. Shifts in Fox Den Occupancy in the Greater Prudhoe Bay Area, Alaska. Arctic. 67(2):196-202.

Suchanek, T.H. 1993. Oil impacts on marine invertebrate populations and communities. American Zoologist. 33:510-523.

Sutherland, B. 2005. Harvest estimates of the Western Arctic caribou herd, Alaska. Rangifer, 25(4), pp.177-184.

Suzuki, K.W., C. Bouchard, D. Robert, L. Fortier. 2015. Spatiotemporal Occurrence of Summer Icthyoplankton in the Southeast Beaufort Sea. Polar Biology, 38, 1379-1389.

Symon, C., L. Arris, and B. Heal, eds. 2005. *Arctic Climate Impact Assessment*. New York, NY: Cambridge University Press.

Talberth, J. and E. Branosky. 2013. Oil & Gas Infrastructure in Cook Inlet, Alaska. Center for Sustainable Economy, West Linn, Oregon.

Tasker M.L. and S. Mustoe. 2003. Bird observations from R/V Gyre, 31 May−21 June 2003, SWSS leg 1, Gulf of Mexico. Texas A&M University, Galveston, TX.

The National Environmental Policy Task Force. 2003. Modernizing NEPA implementation. The NEPA Task Force report to the Council on Environmental Quality. 122 pp.

Thomas, D.R. 1983. Interaction of Oil with Arctic Sea Ice. IN: The Alaskan Beaufort Sea. P. Barnes, E. Reimnitz, and D. Schell (eds.). Academic Press, New York, N.Y. pp. 441-460.

Thompson, M.J., W.W. Schroeder, N.W. Phillips, and B.D. Graham. 1999. Ecology of Live Bottom Habitats of the Northeastern Gulf of Mexico: A Community Profile. Available online at http://www.data.boem.gov/PI/PDFImages/ESPIS/3/3196.pdf. Accessed January 25, 2016.

Thresher, R.E., J.M Guinotte, R.J. Matear, and A.J. Hobday. 2015. Options for managing impacts of climate change on a deep-sea community. Nature Climate Change. 5(7): 635-639. July 2015.

Tillmann, P. and D. Siemann. 2011. Climate Change Effects and Adaptation Approaches in Marine and Coastal Ecosystems of the North Pacific Landscape Conservation Cooperative Region: A Compilation of Scientific Literature Phase 1 Draft Final Report. National Wildlife Federation, Funded by U.S. Fish and Wildlife Service Region 1 Science Applications Program. 279 pp.

Townsend-Small, A., J. McClelland, R.M., Holmes, and B. Peterson. 2006. Carbon and nutrient fluxes from the Alaskan North Slope to the Arctic Ocean. AGU Fall Meeting, San Francisco, CA. Abstract #C44B-06.

Trannum, H.C., H.C. Nilsson, M.T. Schaanning, and S. Øxnevad. 2010. Effects of Sedimentation from Water-Based Drill Cuttings and Natural Sediment on Benthic Macrofaunal Community Structure and Ecosystem Processes. Journal of Experimental Marine Biology and Ecology 383:111–121.

Trefry, J.H., R.D. Rember, R.P. Trocine, and M. Savoie. 2004. Sources, Concentrations and Dispersion Pathways for Suspended Sediment in the Coastal Beaufort Sea. OCS Study MMS 2004-032, MMS, Alaska OCS Region, Anchorage, Alaska.

Trefry, J.H., R.P. Trocine, and L.W. Cooper. 2012. Distribution and Provenance of Trace Metals in Recent Sediments of the Northeastern Chukchi Sea. IN: Chukchi Sea Offshore Monitoring in the Drilling Area (COMIDA): Chemical and Benthos (CAB) Final Report. OCS Study BOEM 2012–012. 311 pp.

Trefry, J.H., R.P. Trocine, L.W. Cooper, and K.H. Dunton. 2014. Trace Metals and Organic Carbon in Sediments of the Northeastern Chukchi Sea. Deep Sea Research Part II: Topical Studies in Oceanography. 102(0): 18– 31.

Trenberth, K.E., L. Smith, T. Qian, A. Dai, J. Fasullo. 2007. Estimates of the Global Water Budget and Its Annual Cycle Using Observational and Model Data. Journal of Hydrometeorology, Vol 8. Issue 4, pp. 758-769.

Turner, R.E., E.B. Overton, N.N. Rabalais, and B.K. Sen Gupta (eds.). 2003. Historical reconstruction of the contaminant loading and biological responses in the Central Gulf of Mexico shelf sediments. U.S. Dept. of the Interior, Minerals Management Service, Gulf of Mexico OCS Region, New Orleans, LA. OCS Study MMS 2003-063. 140 pp.

Turner, R.E., N.N. Rabalais and D. Justic. 2012. Predicting summer hypoxia in the northern Gulf of Mexico: Redux. Marine Pollution Bulletin 64: 318-323. doi: 10.1016/j.marpolbul.2011.11.008.

Turner, R.E., N.N. Rabalais, E.M. Swenson, M. Kapsrzak, and T. Romaire. 2005. Summer hypoxia, northern Gulf of Mexico: 1978 to 1995. Marine Environmental Research 59:65–77.rt

U.S. Commission on Ocean Policy. 2004. An Ocean Blueprint for the 21st Century. Final Report. Washington, DC.

UN (United Nations). 2015. Adoption of the Paris Agreement. Available online at https://unfccc.int/resource/docs/2015/cop21/eng/l09.pdf. Accessed August 3, 2016.

UN. 2016. Intended Nationally Determined Contribution for the United States. Available online at http://www4.unfccc.int/Submissions/INDC/Published%20Documents/United%20States%20of%20America/1/U.S.%20Cover%20Note%20INDC%20and%20Accompanying%20Information.pdf. Accessed August 3, 2016.

United Health Foundation. 2015. America's Health Rankings: Annual Report. Available online at http://cdnfiles.americashealthrankings.org/SiteFiles/Reports/2015AHR_Annual-v1.pdf. Accessed on August 18, 2016.

University of Arkansas. 2016. Alaskan Whaling Villages. Available online at http://www.uark.edu/misc/jcdixon/Historic_Whaling/Villages/Main_Map.htm. Accessed July 18, 2016.

Upton, H. F. 2011. The Deepwater Horizon Oil Spill and the Gulf of Mexico Fishing Industry, Congressional Research Service. Congressional Research Service. Available online at http://fpc.state.gov/documents/organization/159014.pdf. Accessed August 16, 2016.

Urick, R. J. 1983. *Principles of Underwater Sound*. 3rd edition. McGraw-Hill, New York, NY.

USACE (U.S. Army Corps of Engineers). 2012. U.S. Port and Inland Waterways Modernization: Preparing for Post-Panamax Vessels. U.S. Army Corps of Engineers: 103.

USCB (U.S. Census Bureau). 2010. Alaska: 2010 Census of population and Housing Counts. Available online at https://www.census.gov/prod/cen2010/cph-2-3.pdf. Accessed September 1, 2016.

USCB. 2014a. American FactFinder: Poverty Status in the Past 12 Months, 2010-2014 American Community Survey 5-Year Estimates. Kaktovik City, Alaska. Available online at http://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?src=bkmk. Accessed August 20, 2016.

USCB. 2014b. American FactFinder: Poverty Status in the Past 12 Months, 2010-2014 American Community Survey 5-Year Estimates. Nuiqsut, Alaska. Available online at http://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?src=bkmk. Accessed August 20, 2016.

USCB. 2014c. American FactFinder: ACS Demographic and Housing Estimates, 2010-2014 American Community Survey 5-Year Estimates. Nuiqsut City, Alaska. Available online at http://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=ACS_14_5YR_DP05&prodType=table. Accessed August 12, 2016.

USCB. 2014d. American FactFinder: Poverty Status in the Past 12 Months, 2010-2014 American Community Survey 5-Year Estimates. Barrow, Alaska. Available online at http://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?src=bkmk. Accessed August 20, 2016.

USCB. 2014e. American FactFinder: Poverty Status in the Past 12 Months, 2010-2014 American Community Survey 5-Year Estimates. Wainwright, Alaska. Available online at http://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?src=bkmk. Accessed August 20, 2016.

USCB. 2014f. American FactFinder: Poverty Status in the Past 12 Months, 2010-2014 American Community Survey 5-Year Estimates. Point Lay, Alaska. Available online at http://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?src=bkmk. Accessed August 20, 2016.

USCB. 2014g. American FactFinder: Poverty Status in the Past 12 Months, 2010-2014 American Community Survey 5-Year Estimates. Point Hope, Alaska. Available online at http://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?src=bkmk. Accessed August 20, 2016.

USCB. 2014h. American FactFinder: Poverty Status in the Past 12 Months, 2010-2014 American Community Survey 5-Year Estimates. Kenai Peninsula Borough, Alaska. Available online at http://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?src=bkmk. Accessed August 20, 2016.

USCB. 2014i. American FactFinder: Poverty Status in the Past 12 Months, 2010-2014 American Community Survey 5-Year Estimates. Cameron County, Texas. Available online at http://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?src=bkmk. Accessed August 20, 2016.

USCB. 2014j. American FactFinder: Poverty Status in the Past 12 Months, 2010-2014 American Community Survey 5-Year Estimates. Kenedy County, Texas. Available online at http://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?src=bkmk. Accessed August 20, 2016.

USCB. 2014k. American FactFinder: Poverty Status in the Past 12 Months, 2010-2014 American Community Survey 5-Year Estimates. Willacy County, Texas. Available online at http://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?src=bkmk. Accessed August 20, 2016.

USCB. 2014l. American FactFinder: Poverty Status in the Past 12 Months, 2010-2014 American Community Survey 5-Year Estimates. Orleans Parish, Louisiana. Available online at http://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?src=bkmk. Accessed August 20, 2016.

USCB. 2014m. American FactFinder: Poverty Status in the Past 12 Months, 2010-2014 American Community Survey 5-Year Estimates. Harrison County, Mississippi. Available online at http://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?src=bkmk. Accessed August 20, 2016.

USCB. 2014n. American FactFinder: Poverty Status in the Past 12 Months, 2010-2014 American Community Survey 5-Year Estimates. Mobile County, Alabama. Available online at http://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?src=bkmk. Accessed August 20, 2016.

USCB. 2015. State & County QuickFacts, Alaska. 2015. Data derived from Population Estimates, American Community Survey, Census of Population and Housing. Available online at http://quickfacts.census.gov/qfd/states/02000.html. Accessed January 25, 2016.

USEIA (U.S. Energy Information Administration). 2012. Today in Energy, Natural Gas Processing Plant Data Now Available. Available online at http://www.eia.gov/todayinenergy/detail.cfm?id=8530. Accessed October 9, 2015.

USEIA. 2015a. Natural Gas Gross Withdrawals and Production. Natural Gas 2014 (Nov 2015). Available online at https://www.eia.gov/dnav/ng/ng_prod_sum_a_EPG0_FGW_mmcf_a.htm. Accessed September 3, 2016.

USEIA. 2015b. Crude Oil plus Lease Condensate Proved Reserves, Reserves Changes, and Production. Petroleum & Other Liquids 2014 (Nov 2015). Available online at http://www.eia.gov/dnav/pet/pet_crd_cplc_dcu_RLASF_a.htm. Accessed September 3, 2016.

USEIA. 2016a. Primary Energy Consumption by Source. Available online at http://www.eia.gov/totalenergy/data/monthly/#summary. Accessed June 24, 2016.

USEIA. 2016b. Petroleum & Other Liquids: Crude Oil Production. Available online at http://www.eia.gov/dnav/pet/pet_crd_crpdn_adc_mbbl_m.htm. Accessed June 24, 2016.

USEIA. 2016c. Natural Gas: Natural Gas Gross Withdrawals and Production. Available online at http://www.eia.gov/dnav/ng/ng_prod_sum_a_EPG0_FGW_mmcf_a.htm. Accessed June 26, 2016.

USEIA. 2016d. Annual Energy Outlook 2016. Available online at http://www.eia.gov/forecasts/aeo/. Accessed August 19, 2016.

USEIA. 2016e. Short Term Energy Outlook (August 9, 2016 Release Date). Available at http://www.eia.gov/forecasts/steo/report/prices.cfm/. Accessed August 19, 2016.

USEIA. 2016f. Short-Term Energy Outlook, Washington, D.C. July 2016. Available online at http://www.eia.gov/forecasts/steo/. Accessed July 15, 2016.

USEIA. 2016g. Lower 48 Crude Oil Production and Wellhead Prices by Supply Region. Available online at http://www.eia.gov/forecasts/aeo/data/browser/#/?id=71-AEO2016&cases= ref2016~ref_no_cpp&sourcekey=0. Accessed June 24, 2016.

USEIA. 2016h. Lower 48 Natural Gas Production and Supply Prices by Supply Region. Available online at http://www.eia.gov/forecasts/aeo/data/browser/#/?id=72-AEO2016&cases=ref2016 ~ref_no_cpp&sourcekey=0 Accessed June 24, 2016.

USEPA (U.S. Environmental Protection Agency). 1999. Consideration of cumulative impacts in EPA review of NEPA documents. EPA 315-R-99-002. 22 pp.

USEPA. 2006. Regional benefits analysis for the final section 316(b) Phase III Existing facilities rule. EPA-821-R-04-007. 653 pp.

USEPA. 2012. National Coastal Condition Report IV. Office of Research and Development/ Office of Water. United States Environmental Protection Agency. Washington D.C. EPA-842-R-10-003.

USEPA. 2014. Technical Development document for the final section 316(b) Existing facilities rule. EPA-821-R-14-002. 372 pp.

USEPA. 2015a. The Greenbook Nonattainment Areas | Greenbook USEPA. Available online at http://www.epa.gov/airquality/greenbook/. Accessed October 2015.

USEPA. 2015b. Designations | Greenbook | US EPA. Available online at http://www.epa.gov/airquality/greenbook/define.html. Accessed October 2015.

USEPA. 2015c. Visibility Improvement Program - Maps| Air Radiation | US EPA. Available online at http://www3.epa.gov/visibility/maps.html. Accessed October 2015.

USEPA. 2016a. Clean Power Plan for Existing Power Plants. Available online https://www.epa.gov/cleanpowerplan/clean-power-plan-existing-power-plants. Accessed August 3, 2016.

USEPA. 2016b. Inventory of U.S. Greenhouse Gas Emissions and Sinks, 1990–2014. April 15, 2016. Available online at https://www.epa.gov/sites/production/files/2016-04/documents/us-ghg-inventory-2016-main-text.pdf. Accessed September 14, 2016.

USEPA. 2016c. EJScreen Maps: Low-Income Population for Plaquemines Parish, Louisiana. Available online at https://ejscreen.epa.gov/mapper. Accessed August 19, 2016.

USFWS (U.S. Fish and Wildlife Service). 2010. Arctic National Wildlife Refuge, Alaska: Bird List. Available online at https:/www.fws.gov/refuge/arctic/birdslist.html. Accessed August 29, 2016.

USFWS. 2015a. USFWS Administrative Waterfowl Flyway Boundaries. GIS data. Available online at http://catalog.data.gov/dataset/usfws-administrative-waterfowl-flyway-boundaries. Accessed August 15, 2016.

USFWS. 2015b. Endangered Species Search Engine. Available online at http://www.fws.gov/ endangered. Accessed May 10, 2015.

USFWS. 2016. At-Sea Surveys of Seabirds from Ships of Opportunity. USFWS, Anchorage, AK.

Valentine et al. (Valentine, D.L., J.D. Kessler, M.C. Redmond, S.D. Mendes, M.B. Heintz, C. Farwell, L. Hu, F.S. Kinnaman, S. Yvon-Lewis, M.R. Du). 2010. Propane Respiration Jump-Starts Microbial Response to a Deep Oil Spill. Science 330(6001): 208-211.

Valentine, D.L., G.B. Fisher, S.C. Bagby, R.K. Nelson, C.M. Reddy, S.P. Sylva, and M.A. Wood. 2014. Fallout plume of submerged oil from *Deepwater Horizon*. Proceedings of the National Academy of Sciences. 111:15906–15911.

van Vleet, E. S., W. M. Sackett, F. F. Weber Jr and S. B. Reinhardt. 1983. Input of pelagic tar into the northwest Atlantic from the Gulf loop current: Chemical characterization and its relationship to weathered IXTOC-I oil. Canadian Journal of Fisheries and Aquatic Sciences 40(2): 12-22.

van Waerebeek, K., A.N. Baker, F. Felix, J. Gedamke, M. Iniguez, G.P. Sanino, E. Secchi, D. Sutaria, A. van Helden, and Y. Wang. 2007. Vessel collisions with small cetaceans worldwide and with large whales in the Southern Hemisphere, an initial assessment. Latin American Journal of Aquatic Mammals 6 (1): 43–69.

Veil, J.A., T.A. Kimmell, and A.C. Rechner. 2005. Characteristics of Produced Water Discharged to the Gulf of Mexico Hypoxic Zone. ANL/EAD/05-3. Argonne National Laboratory, Argonne, Ill. Available online at http://www.veilenvironmental.com/publications/pw/ANL-hypoxia-report.pdf Accessed January 25, 2016.

Venn-Watson et al. (Venn-Watson, S., L. Garrison, J. Litz, E. Fougeres, B. Mase, G. Rappucci, E. Stratton, R. Carmichael, D. Odell, D. Shannon, S. Shippee, S. Smith, L. Staggs, M. Tumlin, H. Whitehead, and T. Rowles). 2015. Demographic Clusters Identified within the Northern Gulf of Mexico Common Bottlenose Dolphin (*Tursiops truncates* [sic]) Unusual Mortality Event: January 2010 - June 2013. PLoS ONE 10(2):e0117248. doi:10.1371/journal.pone.0117248.

Viereck, L.A., C.T. Dyrness, A.R. Batten, and K.J. Wenzlick. 1992. The Alaska vegetation classification. General technical report PNW-GTR-286. U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station.

Vu, L., M. VanLandingham, M. Do, C. Bankston. 2009. Evacuation and return of Vietnamese New Orleanians affected by Hurricane Katrina. Organization & Environment 2009 22(4):422–436.

Wahrhaftig, C. 1965. Physiographic Divisions of Alaska. Geological Survey Professional Paper 482. United States Government Printing Office, Washington DC. 57p.

Walker et al. (Walker, D.A., K.R. Everett, P.J. Webber, and J. Brown). 1980. Geobotanical atlas of the Prudhoe Bay region, Alaska. U.S. Army Corps of Engineers Cold Regions Research and Engineering, Hanover, NH. Laboratory Report 80-14. 69 p.

Walker, D.A. 1983. A hierarchical tundra vegetation classification especially designed for mapping in Northern Alaska, In: Permafrost, Fourth International Conference Proceeding. July 17-22, 1983. National Academy Press, Washington DC. pp. 1332-1337.

Walker, N. J. and M. A. Smith. 2014. Alaska Waterbird Database v1. Audubon Alaska, Anchorage, AK.

Wallace, R.K. 1996. Coastal Wetlands in Alabama. Circular ANR-831, MASGP-96-018. Auburn University, Marine Extension and Research Center, Mobile, Alabama.

Waller, J.S. and C. Servheen. 2005. Effects of Transportation Infrastructure on Grizzly Bears in Northwestern Montana. The Journal of Wildlife Management. 69(3):985-1000.

Ward, I.A.K, P. Larcombe, and P. Veth. 1999. A new process-based model for wreck site formation. Journal of Archaeological Science. 26, 561-570.

Waring, G.T., E. Josephson, K. Maze-Foley, and P.E. Rosel, eds. 2016. U.S. Atlantic and Gulf of Mexico Marine Mammal Stock Assessments – 2015. NOAA Technical Memorandum NMFS NE 238. 501 pp.

Wassmann. 2011. Arctic Marine Ecosystems in an Era of Rapid Climate Change. Progress in Oceanography, 90, 1-17.

Wassmann. 2015. Overarching Perspectives of Contemporary and Future Ecosystems in the Arctic Ocean. Progress in Oceanography, 139, 1-12.

Wauchope, H.S., J.D. Shaw, O. Varpe, E.G. Lappo, D. Boertmann, R.B. Lanctot, R.A. Fuller. 2016. Rapid climate-driven loss of breeding habitat for Arctic migratory birds. Global Change Biology.

Webster, R.K. and T. Linton. 2013. Development of implementation of *Sargassum* early advisory system (SEAS). Shore and Beach; Journal of the American Shore and Beach Preservation Association. 81: 43-48.

Weeks, W.F., and G. Weller. 1984. Offshore Oil in the Alaskan Arctic. Science 225(4660):371–378.

Wei, C., G.T. Rowe, C.C. Nunnally, M.K. Wicksten. 2012. Anthropogenic ‘‘Litter’’ and macrophyte detritus in the deep Northern Gulf of Mexico. Marine Pollution Bulletin 64:966-973.

Wernham, A. 2007. Iñupiat Health and Proposed Alaskan Oil Development: Results of the First Integrated Health Impact Assessment/Environmental Impact Statement for Proposed Oil Development on Alaska's North Slope. *Ecohealth*. 4(4): 500-513.

White House, Office of the Press Secretary. 2015. Fact Sheet : U.S. Reports its 2025 Emissions Target to the UNFCCC. Available online at https://www.whitehouse.gov/the-press-office/2015/03/31/fact-sheet-us-reports-its-2025-emissions-target-unfccc. Accessed August 3, 2016.

White House. 2016. The Economic Benefits of a 50 Percent Target for Clean Energy Generation by 2025. Available online at https://www.whitehouse.gov/blog/2016/06/29/economic-benefits-50-percent-target-clean-energy-generation-2025. Accessed August 3, 2016.

White, H.K., S.L. Lyons, S.J. Harrison, D.M. Findley, Y. Liu, and E.B. Kujawinski. 2014. Long-Term Persistence of Dispersants following Deepwater Horizon Oil Spill. Environmental Science & Technology Letters. 1(7): 295–299.

WHO (World Health Organization). 2016. Mental Health Topics: Mental Health: Strengthening our Response Fact Sheet no. 220. Updated April 2016. http://www.who.int/mediacentre/factsheets/fs220/en/ Accessed August 25, 2016

Wilcox, C., E. Van Sebille, and B.D. Hardesty. 2015. Threat of plastic pollution to seabirds is global, pervasive, and increasing. Proceedings of the National Academy of Sciences 112(38): 11899-11904.

Wilkinson T., E. Wiken, J. Bezaury-Creel, T. Hourigan, T. Agardy, H. Herrmann, L. Janishevski, C. Madden, L. Morgan, and M. Padilla. 2009. Marine ecoregions of North America. Commission for Environmental Cooperation. Montreal, Canada. 177 pp.

Wilson, R. R., Horne, J. S., Rode, K. D., Regehr, E. V., & Durner, G. M. 2014. Identifying polar bear resource selection patterns to inform offshore development in a dynamic and changing Arctic. Ecosphere, 5(10), 1-24.

Wilson, Ryan R., Lincoln S. Parrett, Kyle Joly, and Jim R. Dau. 2016. Effects of Roads on Individual Caribou Movements during Migration. Biological Conservation 195(2016) 2-8. January 6, 2016.

Wilson, S.G., and T.R. Fischetti. 2010. Population and Distribution and Change: 2000 to 2010: 2010 Census Briefs. Available online at https://www.census.gov/prod/cen2010/briefs/c2010br-01.pdf. Accessed August 23, 2016.

Winsor, M. B. Mate, and L. Irvine. 2015. Spatial Distribution and Density of Satellite-Tagged Sperm Whales in the Gulf of Mexico Before (2001-2005) and After (2010-2013) the *Deepwater Horizon* Oil Spill. Oral Presentation at the 21st Biennial Conference on the Biology of Marine Mammals, 13-18 December, San Francisco, CA, USA.

Witherington, B., S. Hirama and R. Hardy. 2012. Young sea turtles of the pelagic *Sargassum*-dominated drift community: habitat use, population density, and threats. Marine Ecology Progress Series 463:1-22.

Witherington, B.E. and R.E. Martin. 1996. Understanding, assessing, and resolving light-pollution problems on sea turtle nesting beaches. Florida Marine Research Institute Technical Report TR-2, Florida Dept. of Environmental Protection. 73 pp.

Wolfe, R.J. 2013. Sensitive tribal areas on the Arctic slope: An update of areas, issues, and actions in four communities. Prepared by R.J. Wolfe for the Inupiat Community of the Arctic Slope, Barrow, AK.

Wolfe, S.A., B. Griffith, and C.A.G. Wolfe. 2000. Response of reindeer and caribou to human activities. Polar Research, 19(1), pp.63-73.

Wolvovsky, E. and W. Anderson. 2016. OCS Oil and Natural Gas: Potential Lifecycle Greenhouse Gas Emissions and Social Cost of Carbon. BOEM OCS Report 2016-065. 44 p.

Wong, S.N.P., C. Gjerdrum, K.H. Morgan, and M.L. Mallory. 2014. Hotspots in cold seas: The composition, distribution, and abundance of marine birds in the North American Arctic. Journal of Geophysical Research Oceans 119:1691-1705.

Wood, K.R., N. A. Bond, S. L. Danielson, J. E. Overland, S. A. Salo, P.J. Stabeno, J. Whitefield. 2015. A decade of environmental change in the Pacific Arctic region. Progress in Oceanography 136:12–31.

Woods and Poole Economics, Inc. 2015. The Complete Economics and Demographics Data Source on CD-ROM. Available online at https://www.woodsandpoole.com/pdfs/CED12.pdf. Accessed January 25, 2016.

Wormworth J. and K. Mallon. 2006. Bird Species and Climate Change: The Global Status Report: A synthesis of current scientific understanding of anthropogenic climate change impacts on global bird species now, and projected future effects. 75 pp.

Würsig, B. 1988. Cetaceans and Oil: Ecologic Perspectives. IN: Sea Mammals and Oil: Confronting the Risks. J.R. Geraci and D.J. St. Aubin (eds.). Academic Press, San Diego, Calif. pp. 129-165.

Yarbro, L.A. and P.R. Carlson. 2011. Seagrass Integrated Mapping and Monitoring for the State of Florida (Vol. 1). Mapping and Monitoring Report. 202 pp.

Yasue M. 2006. Environmental factors and spatial scale influence shorebirds' responses to human disturbance. Biological Conservation 128:47–54.

Zador, S. (ed.). 2015. Ecosystem considerations 2015: Status of Alaska's marine ecosystems. National Marine Fisheries Service, Alaska Fisheries Science Center, Seattle, WA, 230 p.

Zhang, K. and S. Leatherman. 2011. Barrier island population along the U.S. Atlantic and Gulf coasts. Journal of Coastal Research 27(2): 356-363.

Zimmer et al. Zimmer, B., W. Precht, E. Hickerson, and J. Sinclair. 2006. Discovery of *Acropora palmata* at the Flower Garden Banks National Marine Sanctuary northwest Gulf of Mexico. Coral Reefs 25(2):192.

Appendix G

Comment-Response Matrix

The following table presents all substantive comments received with corresponding responses. Comments are organized alphabetically by commenter. All comments received during the public comment period were considered by BOEM. Comments were received from state and local officials; Federal, state, and local agencies; environmental organizations and NGOs; the oil and gas energy sector; and individuals.

BOEM received approximately 75,000 comments on the Draft Programmatic EIS; the vast majority of these were statements of either support or opposition to the Proposed Action with no substantive material. Comments or letters were received from Federal, state, and local governments and agencies, NGOs, industry associations; however, the vast majority of these were from private citizens. From the comment submittals, BOEM identified 437 substantive comments. Although the comments covered a wide range of topics, most of the comments centered on climate change, the NEPA process and analysis, oil spills and CDEs, alternatives, marine mammals, and sociocultural systems. Please see the comments report at www.boemoceaninfo.com for more details on comment metrics.

Comment ID	Commenter	Comment	Response
399	Advocate Coden	The current PEIS does not reflect numerous known socio-economic issues; that does not protect our Gulf communities.	Information regarding the affected environment for Population, Employment, and Income is presented in Section 4.3, with additional information presented in Appendix C. Potential impacts from the Proposed Action on Population, Employment, and Income are presented in Chapter 4. The level of analysis presented in these chapters is appropriate for a programmatic EIS. Potential impacts on socioeconomic issues are also discussed in the Gulf of Mexico Multisale EIS. For more information on the risks and benefits of the Gulf of Mexico lease sales in the Proposed Program, see the Gulf of Mexico OCS Region Benefits and Risks Section of BOEM's 2017-2022 Outer Continental Shelf Oil and Gas Leasing Proposed Program Decision Document. The "equitable sharing" analysis includes environmental risks of the program proposal, as well as those of the energy substitutes that would most likely take the place of OCS production in the absence of the proposed lease sales (No Action Alternative). The section also provides discussions of increased wages, additional jobs, increased tax collections, and revenue sharing likely to result from the GOM sales.
400	Advocate Coden	Ensure each site specific parish and county have an opportunity to review and provide meaningful input on each impact area.	The Draft Programmatic Environmental Impact Statement (PEIS) document was made available for review on the BOEM website and at public meetings, and was sent via BOEM mailing list or specific request. Comments on the Draft document could be submitted either in person or electronically at the public meetings, via mail, or to regulations.gov website during the 45-day comment period. Online access to the document and comment submittal opportunities either in person, online or via mail provided several mechanisms for public comment.
265	Alex Whiting, Native Village of Kotzebue	The Tribe preferred keeping the Chukchi Sea out of the last two Five Year plans for the reasons of major concerns about the infrastructure capabilities of industry and the Federal Government to manage exploration plans in the Chukchi Sea responsibly, in addition to the lack of sufficient environmental and social baseline information needed to inform effective mitigation measures to ensure unnecessary damage to the environment and natural resources. Instead of leasing these areas and then playing catch up with management plans, studies, and capacity building, the Tribe believes that leasing should follow the conclusion of an all-inclusive and comprehensive management plan for the Arctic seas.	If a decision is made to move forward with any of the proposed lease sales in the Proposed Five Year Program, additional reviews will take place that will be more site-specific and will analyze impacts on listed and non-listed species in greater detail. Subsequent incremental NEPA documents will be written at the individual lease sale level. Although a comprehensive Arctic waters management plan is beyond the scope for the PEIS, BOEM has included consideration of an Alaska Conflict Management Plan. A comprehensive waters management plan for the Arctic is beyond the jurisdiction of BOEM.

Comment ID	Commenter	Comment	Response
266	Alex Whiting, Native Village of Kotzebue	The Tribe believes that the U.S. Federal Government should develop a comprehensive Arctic waters management plan for all industrial activities therein that integrates tribal and community input (especially indigenous knowledge) and involvement, requires long-term monitoring, accounts for cumulative effects, includes designated ecological and cultural exclusion areas from development, a zero discharge mandate and implements scientifically proven mitigation measures for these industrial activities that will impact our food security, way of life, and the health of our peoples.	A comprehensive waters management plan for the Arctic is beyond the jurisdiction of BOEM. The Draft PEIS analyzes potential impacts that could occur from specific activities under the Proposed Action and alternatives, cumulative effects, environmentally important areas, mitigation for these areas which effectively could result in exclusion of OCS activity, and other mitigation measures and stipulations. Discharges are regulated by NPDES permits, which are administered by USEPA. All of these are intended to protect food security, traditional subsistence culture, and human health.
267	Alex Whiting, Native Village of Kotzebue	Additionally, there is currently no mechanism in place to provide direct benefits to communities most at risk for impacts from Chukchi Sea OCS development like a Federal revenue sharing plan. If development proceeds a system of revenue sharing should be implemented to include those affected communities that reside adjacent to the Chukchi Sea and are taking the disproportionate share of the risk from these activities.	A Federal revenue sharing program does not exist in Alaska. Revenue sharing is the purview of Congress and does not fall within BOEM jurisdiction.
268	Alex Whiting, Native Village of Kotzebue	One of the areas that continues to cause much concern is the unmet needs of the Federal agencies (especially the Coast Guard and NOAA), to have the sufficient resources to oversee lease activity in the frontier area of the Chukchi Sea, including basic technical capacities of providing sufficient necessary weather and ice forecasting and the more technically challenging response abilities if the Responsible Parties lose control of a major oil spill event, including a deepwater port site relatively nearby the exploration grounds.	Challenges and limitations of oil spill response in the Arctic are discussed in the Accidental Spills and Catastrophic Discharge Events Section of the PEIS. This includes difficulties from remote access, lack of infrastructure, shallow water limitations, and icy conditions resulting in greater impacts from a potential accidental spill or catastrophic discharge event in the Arctic. As a result of the analysis, overall potential impacts were determined to be up to major depending on the location, timing, magnitude of the event, as well as the effectiveness of the containment and cleanup activities. This PEIS analyzes impacts with existing abilities and infrastructure. An analysis of needs and gaps is not within the scope of this PEIS but is analyzed in other documents that are referenced in the PEIS such as "Responding to Oil Spills in the U.S. Arctic Marine Environment (2014)".

Comment ID	Commenter	Comment	Response
269	Alex Whiting, Native Village of Kotzebue	More work also needs to be done on the rather sketchy across the board assumptions made about oil spill response scenarios based along the Chukchi Sea coast, some examples of areas of concern are: the ability to operate effectively during normal fall time freezing and storm conditions; the capacity to transport and house responders; waste management logistical challenges; and the numbers and ability of small craft available along the coast. More emphasis should be included in the Proposed Program on the real challenges remaining on oil spill response along the coast of the Chukchi Sea and a more thorough discussion of impacts to coastal communities from a VLOS, including perceived impacts that are reasonable to postulate based on the real world impacts to communities and their relationship with marine food harvesting following the Exxon Valdez spill and DWH.	Challenges and limitations of oil spill response in the Arctic are discussed in the Accidental Spills and Catastrophic Discharge Events Section of the PEIS. This includes difficulties from remote access, lack of infrastructure, shallow water limitations, and icy conditions resulting in greater impacts from a potential accidental spill or catastrophic discharge event in the Arctic. Overall impacts on land use and infrastructure were determined to range from minor to major depending on the location, timing, and magnitude of the event, as well as the effectiveness of the containment and cleanup activities. In addition, environmental and Native community impacts that could be associated with a potential spill are summarized. Through the scoping process, BOEM actively solicited the most recent and available science/data necessary to effectively describe all potential impact pathways relevant to the Proposed Action. The level of analysis in the PEIS is in compliance with recent CEQ guidance on programmatic reviews (CEQ 2014) and is an appropriate level of detail for the decision at hand. The analysis is at a national level, and the scope of impacts is described broadly. If a decision is made to move forward with any of the proposed lease sales in the Proposed Five Year Program, additional reviews will take place that will be more site-specific and will analyze impacts on listed and non-listed species in greater detail. Subsequent incremental NEPA documents will be written at the individual lease sale level.
270	Alex Whiting, Native Village of Kotzebue	In the area of climate change an expanded discussion should be included on the potential ecological impacts from a changing food web regime directly related to a loss of sea ice habitat and the associated ice algae ecology, and increasing ocean acidification, that is likely to result in a cascade of effects throughout the trophic levels and species composition.	On August 1, 2016, CEQ issued Final Guidance for the Consideration of Greenhouse Gas Emissions and the Effects of Climate Change in National Environmental Policy Act Reviews. The Final PEIS addresses the effects of climate change consistent with that guidance, including describing the sensitivity of resources to future impacts because of changing climate. BOEM has also quantified downstream greenhouse gas emissions as a proxy for assessing climate change effects.

Comment ID	Commenter	Comment	Response
271	Alex Whiting, Native Village of Kotzebue	Finally, an area the Tribe has emphasized in the past and has yet to be addressed is within the broad context in the section dealing with the expanded risks to other areas of the Nation and as part of the costs if leases are foregone - fossil carbon should be included in this analysis as a major cost, using best estimates of recoverable oil and gas and how much tons of carbon that entire body translates into. The core premise of human induced climate change is based on the introduction of otherwise sequestered (fossil) carbon and related GHG into the biome that would otherwise mainly recycle existing loads of carbon present in the biosphere. The activity being proposed has as its sole focus the freeing of fossil carbon from where it is currently unavailable for release - to be introduced into the existing carbon cycle. Directly acknowledging this as part of the general context of the Proposed Program and during the focused discussions of the cost benefit analysis should be required.	On August 1, 2016, CEQ issued Final Guidance for the Consideration of Greenhouse Gas Emissions and the Effects of Climate Change in National Environmental Policy Act Reviews. The Final PEIS addresses the effects of climate change consistent with that guidance, including describing the sensitivity of resources to future impacts because of changing climate. BOEM has also quantified downstream greenhouse gas emissions as a proxy for assessing climate change effects.
272	Alex Whiting, Native Village of Kotzebue	These Arctic waters are home to an abundance and wide variety of marine life including whales, seals, walrus, fish, and other resident and migratory animals that ensures the food security for our Tribe and many other Alaskan Tribes. Food security is a basic human right recognized by the United Nations and affirmed by the United States in the International Covenant on Civil and Political Rights.	The content referenced by the commenter was taken from the 1966 International Covenant on Economic, Social and Cultural Rights (not ratified by the United States), which addresses the right to food, food security, and food sovereignty. This is different from the requirements ratified by the United States in the International Covenant on Civil and Political Rights. BOEM has determined that no changes to the text are required.
180	Alice Keyes, One Hundred Miles	The agency must conduct significant assessments of the impact potentially permitted activities will have on South Atlantic Assets including Environmentally Sensitive Areas such as Georgia's coastal saltmarshes and Gray's Reef National Marine Sanctuary.	The Atlantic Program Area has been removed from consideration for the 2017-2022 leasing period.
182	Alice Keyes, One Hundred Miles	The agency must conduct significant assessments of the impact potentially permitted activities will have on South Atlantic Assets including Marine Wildlife and their Ocean Habitats. BOEM must carefully evaluate the following species critical habitats as well as the species migratory patterns in the development of the PEIS. These include, but are not limited to: Northern gannet, Shearwaters and petrels, Red phalarope, common loon, black scoter, lesser scup, North Atlantic right whale, West Indian manatee, humpback whale, Loggerhead sea turtle, Kemp's ridley sea turtle, Hawksbill sea turtle, Green sea turtle, leatherback sea turtle.	The Atlantic Program Area has been removed from consideration for the 2017-2022 leasing period.

Comment ID	Commenter	Comment	Response
184	Alice Keyes, One Hundred Miles	The coast of Georgia is home to numerous military installations, including Naval Submarine Base Kings Bay, Fort Stewart, and Hunter Army Airfield. Prior to making a final decision about where to allow oil and gas development and exploration activities, BOEM must carefully consider the impact offshore activities will have on military operations and the communities dependent upon them. In the "DoD Mission Compatibility Planning Assessment: BOEM 2017-2022 Outer Continental Shelf (OCS) Oil and Gas Leasing Drat Proposed Program" (Compatibility Report), the DoD categorized locations within each of BOEM's Atlantic OCS planning areas including the Jacksonville Operations Area (OPAREA) in which the coast of Georgia falls. While the report contains a great deal of redacted information it clearly limits offshore activities in the majority of land off Georgia's shore potentially open for lease sales.	The Atlantic Program Area has been removed from consideration for the 2017-2022 leasing period.
195	Alice Keyes, One Hundred Miles	The attached PDF identifies environmentally and historically sensitive species, land areas, and offshore assets that must be evaluated should BOEM choose an alternative that includes the Atlantic OCS.	The Atlantic Program Area has been removed from consideration for the 2017-2022 leasing period.
203	Andrew Hartsig, Ocean Conservancy, Audubon Alaska, Oceana, Pew Charitable Trusts, WWF	The Draft PEIS does not recognize Herald Shoal as an EIA or as a candidate for programmatic mitigation and does not offer an explanation for this omission. The entire Barrow Canyon area merits recognition as an EIA. The whole of Smith Bay merits recognition as an EIA. The Draft PEIS recognizes the area around Harrison Bay as an EIA that is considered for programmatic mitigation in the form of a time-area closure but fails to consider exclusion of the area to provide protections for marine and coastal birds and marine benthic communities. The Draft PEIS considers, but eliminates from further consideration, two additional exclusions in the Beaufort Sea: an offshore beluga feeding area located north of Kaktovik along the eastern Beaufort shelf break and a deepwater area seaward of the 200m isobath. Contrary to this conclusion, the best available science indicates that these areas contain important environmental values. We urge BOEM to recognize these areas along the Beaufort Shelf break as EIAs. The best available science also indicates that the Draft PEIS omits key areas that contain important environmental values. As described above, these areas include: Herald Shoal, the northeast waters of Barrow Canyon, additional portions of Smith Bay, and the Beaufort Shelf Break.	BOEM considered Herald Shoal during development of alternatives for the Draft PEIS and determined it was not appropriate for further analysis at the Five Year stage. The dismissal justification was not provided in the Draft PEIS due to BOEM's error. BOEM has added a discussion of Herald Shoal under Alternatives Considered but Dismissed from Programmatic Evaluation. BOEM also considered recommendations for extending the Barrow Canyon EIA analyzed in this PEIS to the northeast and southeast (Smith Bay) and for excluding the Beaufort Shelf Break. The dismissal justification for these areas may be found in Chapter 2 of this PEIS.

Comment ID	Commenter	Comment	Response
204	Andrew Hartsig, Ocean Conservancy, Audubon Alaska, Oceana, Pew Charitable Trusts, WWF	All Environmentally Important Areas should be excluded from the 2017–2022 leasing program and given the strongest protections possible within the Department of the Interior's authority. Time-area closures and mitigation measures suggested in the Draft PEIS would not offer adequate protection.	The PEIS analyzes mitigation measures up to and including exclusions of EIAs to reduce impacts. This information will be used to inform future decisions.
205	Andrew Hartsig, Ocean Conservancy, Audubon Alaska, Oceana, Pew Charitable Trusts, WWF	Consultation with local communities is of the utmost importance. BOEM should ensure meaningful consultation, including consultation concerning indigenous knowledge and subsistence.	BOEM conducted a scoping period in early 2015 and provided a public comment period on the Draft PEIS in early 2016. Both of these periods included public meetings in areas that may be affected by leasing under the 2017-2022 Oil and Gas Leasing Program. BOEM actively seeks input from local communities to ensure that concerns and potential impacts are addressed adequately. Gaining knowledge of how BOEM activities could affect traditional ways, subsistence, and indigenous cultural resources is essential to BOEM's decisionmaking, along with government-to-government consultations, community and public meetings, and other special activities.
207	Andrew Hartsig, Ocean Conservancy, Audubon Alaska, Oceana, Pew Charitable Trusts, WWF	BOEM should give special consideration to addressing additional science gaps.	The BOEM Environmental Studies Program develops, conducts, and oversees world-class scientific research specifically to inform policy decisions regarding development of OCS oil and gas resources. New studies are proposed on a yearly basis as data gaps are identified and funded following a careful review process. The PEIS acknowledges missing or incomplete information as appropriate. New data and information can be incorporated into environmental analyses throughout the phased leasing process.
55	Andrew Tooyak	What was excluded in the last process by the lack of a detailed PEIS was a Bowhead Whale strike share distribution process exercised by Qaligi of Point Hope that could have potentially been affected in the human environment if an oil spill occurred, no matter how remote that possibility was. This Bowhead Whale strike share distribution process was not even mentioned in the mitigation measures in an incomplete Environmental Impact Assessment (EIA) of Chukchi Sea Lease 193. The strike share distribution process cannot be mitigated for.	The Bowhead Whale strike share distribution process is instituted and managed by the AEWC and its member villages. The potential of oil and gas activities to impact bowhead whale subsistence hunting is discussed in the Sociocultural Systems Sections of the PEIS. Further analysis will be conducted at the lease sale stage, if appropriate.

Comment ID	Commenter	Comment	Response
216	Andy Moderow, Alaska Wilderness League	I thank you, the Bureau of Ocean Energy Management, for the opportunity to comment, but I am saddened that I am not being able to testify in front of a committee, and that we, as Alaskans, we, as voting representatives and citizens, deserve that opportunity, to speak to you in front of a committee.	BOEM has found that the PEIS meeting formats used are an excellent way to engage with the public, provide flexible hours to the public for attendance, answer technical questions individually and in small groups, and educate personally on the best way to submit comments that will provide useful input to the PEIS process. Public comments are considered in the exact same way regardless of the format in which they are received.
217	Andy Moderow, Alaska Wilderness League	The first step is to remove the lease sales scheduled in 2017 through 2022. When oil and water mix, little could be done, and today that region is still recovering. What would have happened if, in addition to water and oil, ice had been added to the equation? This would have made the already impossible response even more impossible. We know that this development can't be done safely, not with today's technology.	The PEIS identifies and discusses the differences and challenges of spill response in the Alaskan environment in the Accidental Spills and Catastrophic Discharge Events Section, Chapter 4, dealing with ice, cold, and limited daylight conditions. Individual resources potentially impacted by a catastrophic discharge event (CDE), including those in Alaska, are discussed in the Potential Impacts per Resource Area Section, Chapter 4. This analysis of potential impacts is broad and considers entire planning areas. At subsequent lease sale stages, more specific information will be available regarding the location and level of activity, spill risk of proposed activities, and specific environmental resources in the area. At subsequent stages, BOEM might also conduct Oil Spill Risk Analysis modeling to better estimate spill risk, spill trajectories, and probability of contact with an environmental resource.
218	Andy Moderow, Alaska Wilderness League	We Alaskans are feeling the effects of climate change today. We also felt them yesterday, the week before, all winter for that matter. In 2015, the community of Kivalina got ten feet closer to the ocean, the result of an unseasonable storm eroding the shoreline. We hit 71 degrees in March in the state of Alaska. We've had three wildfires already this year, before wildfire season has even begun. And this trend will continue, and it get worse, and it will become unstoppable, unless we take bold action today.	On August 1, 2016, CEQ issued Final Guidance for the Consideration of Greenhouse Gas Emissions and the Effects of Climate Change in National Environmental Policy Act Reviews. The Final PEIS addresses the effects of climate change consistent with that guidance, including describing the sensitivity of resources to future impacts because of changing climate. BOEM has also quantified downstream greenhouse gas emissions as a proxy for assessing climate change effects.

Comment ID	Commenter	Comment	Response
357	Andy Radford, American Petroleum Institute et al.	Although the Draft PEIS attempts to account for present actions affecting the resources that would also be affected by implementation of the Program and considers other future oil and gas and similar activities that would also have impacts cumulative with the impacts of the Proposed Program (see pp.3-38 and 4-156), with perhaps the exception of the future impacts of stricter USEPA marine fuel standards, the Draft PEIS completely fails to consider other reasonably foreseeable future non-oil and gas related activities that would have cumulative effects with the Proposed Program. The same generic impact criteria used to determine the level of direct and indirect effects are also applied to the cumulative impacts analysis. The Associations are concerned that as a whole, the cumulative effects analysis lacks any quantified or detailed information, without which we cannot determine or be assured that the CEA is considered adequate under NEPA. The Associations encourage BOEM to reconsider its approach to analyzing impacts across all program areas and consider conducting the direct, indirect and cumulative impact analysis on an area-by-area basis. At a minimum this would recognize distinctions between levels of effect by planning area.	The level of analysis in the PEIS is in compliance with recent CEQ guidance on programmatic reviews (CEQ 2014) and is an appropriate level of detail for the decision at hand. The analysis is at a national level, and the scope of impacts is described broadly. The cumulative effects analysis in Chapter 4 has been revised to provide additional support by resource for the conclusions regarding the incremental contribution to cumulative effects. In addition, cumulative effects are discussed by program area as appropriate.
358	Andy Radford, American Petroleum Institute et al.	The Associations are concerned with BOEM's analysis regarding air quality in the Gulf of Mexico Region. The Draft PEIS conclusion (moderate air quality impacts for the Gulf of Mexico Program Area, page xiii) is not consistent with others in the record, made by the same agency, and BOEM provided no information to substantiate the change. Given BOEM's recent proposal to fundamentally alter the current Air Quality Regulatory Program (AQRP) when the agency itself, including neighboring states, have repeatedly concluded that offshore emission sources do not contribute significantly to onshore air quality the Associations question if this change in the perceived air quality environmental impacts in the Gulf of Mexico is an attempt to wrongfully justify the need for new regulations.	The impact level has not been modified because an interim deliverable from an ongoing BOEM study has found a contribution to ambient air quality offshore, over State submerged lands, onshore, and in nearby Class I Areas. Although the study is not complete a more thorough discussion will be included in future lease sale documents.

Comment ID	Commenter	Comment	Response
359	Andy Radford, American Petroleum Institute et al.	Adaptive management could provide the built-in flexibility necessary for successfully balancing ecosystem management principles with prudent oil and gas exploration and development. However, this Draft PEIS does not provide a better understanding of the systematic process BOEM will use to implement adaptive management concepts. The Draft PEIS refers to adaptive management as a means to further restrict activities with no option to lessen restrictions based on site-specific assessments or new data. This is not adaptive, but prescriptive – such as identifying areas for potential exclusion or other programmatic mitigation over the life of the Program. The Associations support using adaptive management to help manage environmental effects when the design of the adaptive management program actually assesses how effective the program is at mitigating impacts. We request that BOEM hold a workshop or provide additional opportunities for future dialogue on adaptive management.	The PEIS refers very broadly to the OCSLA staged process that may allow for the re-consideration of additional information and clarifying of mitigation at subsequent decision points. Adaptive management as a management strategy allows for actions to be adjusted during implementation to meet desired outcomes. BOEM does not specifically describe or propose an adaptive management framework for the Five Year Program as envisioned by the comment. However, the Department of the Interior's NEPA regulations at 43 CFR 46.415 do allow for BOEM to consider actions or alternatives that include adaptive management strategies that would allow for adjustment of the action during implementation. BOEM has not expressly attempted to do so in this PEIS. The PEIS does not lay out an iterative process that allows for reconsideration of the merits and effectiveness of the exclusions of EIAs or programmatic mitigations under consideration in the framework of alternatives. However, consistent with the staged OCSLA process, if new or additional information becomes available, BOEM may further clarify programmatic mitigation or add site-specific mitigation at the lease sale or plan stage. Text has been revised per comment.
360	Andy Radford, American Petroleum Institute et al.	In light of the conclusions presented in the Draft PEIS environmental effects analyses, and the already considerable mitigation measures required for several EIAs, the Associations find that BOEM should state in the Final PEIS and Final PP that those spatially defined EIAs identified in Alternative B as potential areas of programmatic mitigation will not be considered for further mitigation in the Final PP.	The PEIS does not include any requirements for mitigations in EIAs. The PEIS analyzes mitigation measures up to and including exclusions of EIAs to reduce impacts. This information will be used to inform future decisions. The analyses provide information to the decisionmaker and no outcome is presumed.

Comment ID	Commenter	Comment	Response
361	Andy Radford, American Petroleum Institute et al.	The Associations are concerned that the "mitigation hierarchy" used in this process largely focused on areas considered "unsuitable" for oil and gas development and is based on the same overly-conservative, fundamentally-flawed precautionary mitigation measures and unsupported assumptions discussed in previous paragraphs of this review that have been carried over directly into the DPP, the PP, and the Draft PEIS without further review or discussion. The Associations do not support the decisions made by BOEM in the development and implementation of the overly precautionary mitigation measures incorporated into this Draft PEIS. They are unrealistic and ineffective, and therefore unfair to industry, because they overstate the potential for impact in some cases by several orders of magnitude. Given that the mitigation measures described in the Draft PEIS for the 2017-2022 Program continue to stretch the use of the term "best available" data, the Associations do not concur that the mitigation measures and conservation requirements adopted in the Draft PEIS are reasonable or have been fairly assessed.	BOEM followed current CEQ guidance in developing the mitigation hierarchy and landscape scale alternatives for review by the Secretary. BOEM uses the best available science and CEQ guidance on NEPA implementation to develop appropriate mitigation measures that balance protection of the environment with the nation's energy needs. However, the information provided in the PEIS related to mitigation measures, including the EIAs analyzed under Alternative B, were not adopted as suggested by the commenter. The analysis related to EIAs demonstrates, with appropriate support, that by reducing or avoiding activity in certain areas, impacts also could be avoided or reduced. The decision whether to select or implement these, either at the Program level or at subsequent stages, is not a component of the PEIS.
362	Andy Radford, American Petroleum Institute et al.	The Associations believes that the local uses of the OCS can co-exist with the stipulations and mitigations that are already in place. Therefore, we recommend that the Draft PEIS include a discussion of the proposed oil and gas development activities in this region and the mitigation that has been developed to avoid or minimize potential adverse effects in an attempt to bridge the conflicting user-groups.	Mitigation measures are described in Appendix I. In addition, implementation of an Alaska Conflict Management Plan has been analyzed in the Final PEIS.

Comment ID	Commenter	Comment	Response
366	Andy Radford, American Petroleum Institute et al.	The Associations have serious concerns about the criteria used to identify EIAs as well as the mitigations proposed to protect them. BOEM is also incorporating certain very site-specific mitigations that are typically determined in a tiered NEPA analysis rather than at this programmatic level Draft PEIS. For example, stipulations for the Flower Garden Banks are analyzed as presented on pages 4-152 and 4-153 (Draft PEIS), indicating the potential for very specific mitigations in that area. Similarly, specific temporal closures are suggested for the four Alaska OCS EIAs. Furthermore, there is no practical difference between Alternative B (Reduced Proposed Action) and C (No Action) for the Alaska OCS if temporal closures are implemented for the four EIAs identified because doing so would effectively mean no exploration or development activities could occur due to the overly-restrictive closure. Section 2.7 and Table 2.7-1 (Draft PEIS) compare potential impacts to resources across alternatives and program areas. Most analyses indicate the potential for negligible to minor (most common) impact with moderate to major impacts potentially occurring in coastal areas and communities of Alaska (Table 2.7-1). Therefore, reducing areas available to potential oil and gas activities as described in Alternative B would, based on the Draft PEIS analysis, result in negligible environmental benefit.	The PEIS does not include any requirements for mitigation measures in EIAs. The PEIS analyzes mitigation measures up to and including exclusions of EIAs to reduce potential impacts. This information will be used to inform future decisions. The analyses provide information to the decisionmaker and no outcome is presumed. Additional information on the justification for selection of EIAs has been added to the document. The commenter is correct in saying that the specific topographic features stipulations have been considered at the lease sale stage in the past. BOEM feels that the inclusion of these stipulations in every applicable lease since 1996 could be streamlined by analyzing and adopting them at the programmatic level.

Comment ID	Commenter	Comment	Response
367	Andy Radford, American Petroleum Institute et al.	The Associations believe that it is inappropriate to use the NEPA analysis to identify EIAs without going through an iterative analytical review. And in this case, such a process does not fit into the OCSLA Section 18 framework, since program areas cannot be adjusted at later stages. Although the Draft PEIS explains why these areas are either ecologically important or important for subsistence and traditional purposes, it does not explain why excluding these areas from the Program is necessary. The potential environmental consequences of oil and gas activities in these areas are considered negligible, minor or moderate. BOEM does not assert that oil and gas leasing in these areas would have unacceptable impacts, nor does it even consider what impacts leasing in these areas might have. The Draft PEIS fails to consider the extent to which oil and gas activities might impact, if at all, subsistence hunting or traditional uses of these areas, although it obliquely suggests that impacts to subsistence fishing are at least partially why BOEM would exclude these areas from leasing consideration. In addition, the categorization and application of EIAs as a form of mitigation is not clear in the Draft PEIS. BOEM assumes that where multiple uses or users overlap spatially, there may be a need to restrict one or more activity to minimize potential conflict. This view is largely unsupported by the evidence. Alternatives and mitigation measures cannot be imposed to counteract "purported effects" for which there exists no credible scientific proof. The Draft PEIS violates these precepts throughout the document.	Additional information has been added to the document to better describe the justification for analyzing the EIAs. BOEM identified and analyzed EIAs in the Draft PEIS to include sensitive ecological or sociocultural resources that could experience reduced impacts from the Proposed Action if the EIA were excluded or if mitigation measures were employed within that area. These areas were analyzed in Alternative B because exclusion of or application of mitigation measures within them is expected to mitigate impacts from the Proposed Action not because "oil and gas leasing in these areas would have unacceptable impacts". This is supported by the analyses in the Final PEIS. In addition, the PEIS does consider what oil and gas leasing impacts could occur in these areas - these areas are part of the Proposed Action analyses - and particularly what those impacts could be to subsistence hunters and what the reduction in impacts could be under Alternative B. BOEM has also added to the PEIS consideration of a mitigation measure to require an Alaska Conflict Management Plan for leasing activities in the Alaska program areas to address space-use conflicts that are not addressed through Alternative B. The categorization of EIAs in the PEIS demonstrates how each was developed and considered. The PEIS provides information that could be used to make decisions at the Program stage or at subsequent decision points. It does not presume any outcome.

Comment ID	Commenter	Comment	Response
370	Andy Radford, American Petroleum Institute et al.	The Draft PEIS must reflect programmatic needs and goals. Congress was explicit in its programmatic goals under OCSLA. Congress mandated these programmatic goals when it substantially amended OCSLA in 1978 for the express purpose of "promoting the swift, orderly and efficient exploitation of our almost untapped domestic oil and gas resources in the Outer Continental Shelf." Despite these clear statements of Congressional intent and programmatic goals, the Associations question whether the range of alternatives evaluated in the Draft PEIS represents a framework for accomplishing the goals under OCSLA. The alternatives go from restrictive to even more restrictive based on time-area closures and exclusion zones that would make prudent oil and gas development nearly impossible. This approach is overly restrictive not only under NEPA but also under the balanced approach that Section 18 of OCSLA mandates. For example, BOEM directly states in the Draft PEIS (p. 2-10) that the temporal closures proposed under Alternative B for the Alaska OCS would make development in the region extremely difficult. This is a fundamental flaw in both the Draft PEIS and the BOEM analytical process that goes against the guidance from CEQ for a programmatic assessment that evaluates a "reasonable range of alternatives" that go from broad-based programs to more site-specific, regional actions. Instead, BOEM's proposed alternatives include very specific, regional actions supported by a very general analysis that lacks sufficient rationale.	The goal of expeditious development does not necessarily mean that every Five Year Program needs to offer leases in all locations. This discretion is left to the Secretary. The decisions associated with Program development necessarily narrow the Proposed Action and the realm of possible alternatives. It is not reasonable to analyze an alternative that cannot be selected by the Secretary because it does not meet the Purpose and Need of setting a schedule of leases per the requirements of OCSLA. The alternatives in the PEIS are not restrictive - they analyze full implementation of the Proposed Action as well as landscape-level planning options that would avoid or minimize impacts. CEQ's guidance on the use of programmatic NEPA analysis clarifies that a PEIS can set the stage for subsequent, "narrow" actions. The PEIS serves the purpose of a programmatic document by facilitating decisions that "precede site- or project-specific decisions".
371	Andy Radford, American Petroleum Institute et al.	The Associations recognize that a programmatic EIS takes a broader approach to environmental assessment than subsequent EISs or EAs that tier from this Draft PEIS. However, the levels of analyses in sections of this Draft PEIS are a result of “averaging” a predicted level of effect from the Proposed Action on each resource across program areas (Section 2.7). As such, the absolute minimum amount of relevant information on potential effects of the action is presented OCS-wide while individual leases are confined to a specific OCS area. In so doing, the analysis gives the impression that the environmental conditions in each lease sale area are similar and can be compared OCS-wide, which is not the case. Lacking more specific information and supporting rationale behind the effects criteria and the associated conclusions, the Draft PEIS becomes an ineffective tool for informing or guiding agency managers on how to differentiate between activities that have no effect, a minor or major effect to a few animals, or major effects to an entire population.	BOEM incorrectly stated in the Draft PEIS Section 2.7 that impacts were averaged; the full range of impacts were reported in Chapter 4 and the Final PEIS reflects this. BOEM did not average any impacts. The level of analysis in the PEIS is an appropriate level for the decision at hand. If a decision is made to move forward with any of the proposed lease sales in the Proposed Five Year Program, additional NEPA reviews will take place that will be more site-specific and will analyze impacts in greater detail.

Comment ID	Commenter	Comment	Response
372	Andy Radford, American Petroleum Institute et al.	The Draft PEIS acknowledges the requirement to utilize best available science and assert the agencies have met this requirement. Industry does not share that assessment. The Associations continue to be concerned that, while BOEM may continue to have access to the best available information and scientific results, these data and results continue to be mis-applied or ignored in the decisionmaking process. This is most evident in the decision to withdraw the Atlantic OCS planning areas from the 2017-2022 Program for potential leasing. Based on the analyses of impacts in the Draft PEIS there is no reasonable or clear justification for removing the Atlantic lease sale from the 2017-2022 Program. In fact, there is no discussion of the removal of this program area in the Draft PEIS at all, which is especially troublesome. NEPA requires that alternatives eliminated or modified must be briefly described along with a discussion on the reasons for doing so. We continue to be disappointed that BOEM has not relied on the best available science and analyses of effects in the Draft PEIS, including the results of over a decade of studies that were funded, for the most part by BOEM as part of its Environmental Studies Program specifically for their decisionmaking process. Instead, BOEM has become more and more reliant on public opinion and short-term political decisions, which seems to be the case for removing the Atlantic from the proposed lease sale program for 2017-2022.	Decisions on the schedule of lease sales is the purview of the Secretary of the Interior; these decisions are based on numerous factors, including potential for oil and gas resources, economic considerations, and environmental considerations. Information in the Draft PEIS was available to the Secretary prior to her decision to remove the Atlantic Program Area. A full description on why the Atlantic Program Area was removed from consideration can be found in the 2017-2022 OCS Oil and Gas Leasing Proposed Program. The Final PEIS has been updated (Chapter 2) to discuss the removal of this area from consideration for leasing.
373	Andy Radford, American Petroleum Institute et al.	In recognition of the fact that the environment, ecology, economy, and attributes of the Gulf of Mexico, the Atlantic, and the Arctic are distinct from one another, the Draft PEIS generally treats the environmental analysis for each planning region separately. However, in a number of instances, BOEM inexplicably abandons this approach, opting instead to discuss certain types of Program impacts generically, without regard to region or the unique conditions presented by those regions. To the extent that BOEM abandons its regionally-based assessment of impacts, it unnecessarily invites would-be challengers to dispute the adequacy of its analysis. Therefore, BOEM should ensure that all its impact assessments are tailored to the relevant regions, and if BOEM anticipates that a suite of impacts will be identical across regions, it should say so and explain why.	BOEM recognizes that the program areas differ in environment, ecology, economy and attributes. The impacts of the Proposed Action and alternatives (where applicable) are discussed by resource area and by program area if necessary. Impact producing factors and associated impacts are often common across program areas; where they are not, specific geographic information is presented. This approach is stated in the introductory material to the impact assessment (Section 4.1). The level of analysis is appropriate for a programmatic document as provided in CEQ's guidance on Effective Use of Programmatic NEPA Reviews and in accordance with 40 CFR 1502.16 and 43 CFR 46.415.

Comment ID	Commenter	Comment	Response
374	Andy Radford, American Petroleum Institute et al.	The Associations are concerned with the statement by BOEM that "at the Five Year Program stage it is not possible to perfectly identify the nature and scope of IPFs of future activities." This statement undermines the value of the Draft PEIS. We recognize that each phase of activity (geophysical, exploration, development, and production) will have a set of IPFs that may affect physical or environmental conditions and may affect one or more resources. At each phase of the methodology, the Draft PEIS continually states that the effects cannot be accurately or adequately discerned due to one or more factors. This statement raises concerns as to whether the results in the Draft PEIS provide a reasonable assessment of future, foreseeable impacts of the three alternatives.	Text has been revised per comment to clarify the intent of the sentence. BOEM actively solicited the most recently available science/data necessary to effectively describe all potential impact pathways relevant to the Proposed Action during the scoping process. The level of analysis in this PEIS is in compliance with recent CEQ guidance on programmatic reviews (CEQ 2014) and is an appropriate level of detail for the decision at hand. The analysis is at a national level, and the scope of impacts is described broadly. The anticipated context and intensity of impacts from proposed OCS oil and gas E&D activities are discussed in Chapter 4. If a decision is made to move forward with any of the proposed lease sales in the Proposed Five Year Program, additional environmental reviews would take place that would be more site-specific and analyze impacts on ESA listed and non-listed species in greater detail. Subsequent NEPA documents would be written at the individual lease sale level.
375	Andy Radford, American Petroleum Institute et al.	BOEM has amassed a considerable amount of information in the Draft PEIS description of the affected environment that details the various environmental receptors in each relevant region that may be affected by implementation of the Program. In a number of instances, however, the information on the affected environment is not utilized to assess the environmental impacts of Program implementation. Failure to connect the dots between the affected environment and the Proposed Action's effects on that environment is a potential NEPA deficiency. Accordingly, BOEM should ensure that the Draft PEIS fully accounts for all of the reasonably foreseeable effects of its proposal on the affected environment described in the Draft PEIS. Because BOEM's failure to consider the impacts of the Proposed Program on these and other aspects of the affected environment presents a potential NEPA vulnerability, BOEM should ensure that the Final PEIS adequately connects the dots between the described affected environment and the impacts of the Proposed Action and alternatives, and takes a hard look at all the reasonably foreseeable impacts of the Program.	BOEM has reviewed the description of the affected environment, the effects baseline presented in the No Action Alternative, and the impacts analysis for the Proposed Action and alternatives to ensure that they capture the breadth of the potential impacts. The level of analysis in the PEIS is in compliance with recent CEQ guidance on programmatic reviews (CEQ 2014) and is an appropriate level of detail for the decision at hand. The analysis is at a national level, and the scope of impacts is described broadly. If a decision is made to move forward with any of the proposed lease sales in the Proposed Five Year Program, additional reviews will take place that will be more site-specific and will analyze impacts on listed and non-listed species in greater detail. Subsequent incremental NEPA documents will be written at the individual lease sale level.
593	Andy Radford, American Petroleum Institute et al.	Further, the "averaging" of potential impacts of the alternatives across OCS program areas goes against CEQ guidance to describe both the context and intensity of a potential impact.	BOEM did not average any impacts. The statement in the Draft PEIS to this effect was erroneous and has been corrected in the Final PEIS.

Comment ID	Commenter	Comment	Response
594	Andy Radford, American Petroleum Institute et al.	Further, since the Draft PEIS assesses impacts across the full range of potential effects in each of the five program areas, most conclusions on direct and indirect impacts involve considerations that are common throughout the program area, and some conclusions on impacts cross all program areas. For these reasons BOEM further states that the discussion of impacts for Alternative A in Section 4.4.1 is not structured by area and does not address specific OCS planning areas and "the exact context and intensity of impacts from further OCS and gas activities cannot be identified without knowing specific location and design details." As stated earlier, despite this conclusion, very specific mitigation measures are being introduced to address impacts that have been assessed on a very broad scale.	The consideration of mitigation measures in the PEIS provides an avenue for reduction of potential impacts from the Proposed Action; these mitigation measures could be adopted under any action alternative, be chosen or implemented at subsequent decision points, or be deemed unnecessary or not beneficial. The PEIS is an informational document that does not presume nor prescribe any outcome.

Comment ID	Commenter	Comment	Response
595	Andy Radford, American Petroleum Institute et al.	The DPP states that "preparation of the PP will be based on additional analyses of required OCSLA Section 18 factors and comments received by BOEM on the DPP and NOI to prepare the Draft PEIS" (Chap. 1.2.3 PP and Draft PEIS). BOEM is, among other things, using the Draft PEIS to comply with the mandate in Section 18(a) of OCSLA to consider environmental values of the OCS and the potential impact of oil and gas exploration on other resource values of the OCS and the marine, coastal, and human environments when formulating the Program. This OCSLA mandate is consistent with the core purpose of NEPA, which is to inform agency decisionmaking. However, based on the content of the Draft PEIS, it is unclear whether BOEM is using the Draft PEIS to inform its Program-related decisionmaking, or is using it simply to disclose the impacts associated with Program decisions the agency already made. In the Associations' view, the NEPA analysis does not support the decisions made by the Secretary. For example, BOEM based the Draft PEIS Proposed Action alternative on the contents of its March 2016 Proposed Program, which the Agency formulated prior to engaging in the NEPA analysis of that Program's impacts. See Draft PEIS at 2-5. If so, this would have the NEPA process backwards. BOEM's NEPA analysis, including the identification of a reasonable range of alternatives, should predate program proposals, and indeed should help form the basis of its proposals, not the other way around. To the extent BOEM is using the Draft PEIS simply to report the environmental consequences associated with a Program it has already decided to pursue, BOEM has failed to use the Draft PEIS for its intended purpose under NEPA and OCSLA. In so doing, BOEM risks considering a range of Program alternatives that is too narrow, and risks producing environmental impact analyses that are merely confirmatory of the decisions the agency has already made. BOEM should explain how the analysis that appears in the Draft PEIS was actually used to formulate BOEM's March 2016 Proposed Program.	The Draft PEIS page cited by API expressly states, “[t]he DPP released on January 29, 2015, provided the basis of the Proposed Action for this Programmatic EIS.” (See Draft PEIS at 2-5.) API also asserts that “BOEM's NEPA analysis, including the identification of a reasonable range of alternatives, should predate program proposals, and indeed should help form the basis of its proposals, not the other way around.” This statement is incorrect because it presumes that the Secretary must conduct a NEPA analysis to determine what the Section 18 proposal will be. But NEPA analysis is performed to analyze a proposal, not to create a proposal. The NEPA analysis of that proposal informs the final decision. Determinations of the scope of the proposal at the different stages of the Section 18 process are dictated by the iterative nature of that process and are not constrained, but assisted, by the agency’s decision to perform a NEPA analysis. The preparation of the 2017-2022 Proposed Program – including the determination not to include the Atlantic for further consideration – was based on Section 18 considerations, comments received by BOEM on the DPP and the NOI to prepare the Draft PEIS, and consideration of the environmental analysis performed for the Draft PEIS. The analysis contained in this Final PEIS covers the Proposed Action, the 2017-2022 Proposed Program, as well as a reasonable range of alternatives that allows the Secretary to evaluate their environmental impacts and reach a decision on a 2017-2022 Proposed Final Program in accordance with the OCSLA Section 18 process.
596	Andy Radford, American Petroleum Institute et al.	The Associations request that BOEM consider the comments on the Draft PEIS as part of the OCSLA decisionmaking process.	BOEM considers the comments on the Draft PEIS and makes the necessary revisions to the Final PEIS. Information on the Final PEIS analyses and comment responses is provided to the decisionmaker as a component of the OCSLA Section 18 factors.

Comment ID	Commenter	Comment	Response
597	Andy Radford, American Petroleum Institute et al.	At a minimum, the Record of Decision BOEM will produce when it finalizes the 2017-2022 Program, and which must both identify the alternative the agency ultimately selects and provide appropriate rationale for, should reflect BOEM's consideration of the information presented in the Draft PEIS.	The ROD will identify the Agency's decision and the environmentally preferred alternative as required by NEPA. The decision will include all relevant information and necessary justification per OCSLA.
598	Andy Radford, American Petroleum Institute et al.	The Associations believe that eliminating the eastern GOM option from consideration in the Draft PEIS creates a disconnect in the justification of Program decisions, offers little flexibility for decisionmakers and narrows potential alternatives over the five year period without providing adequate rationale. We find that this request to include the eastern GOM in the alternatives was both reasonable and prudent pursuant to NEPA, and should have been fully analyzed in the Draft PEIS.	The portions of the Eastern Gulf of Mexico Planning Area not included in the Gulf of Mexico Program Area are under Congressional Moratorium and cannot be leased prior to 2022. Analysis of these areas as an alternative in the PEIS is not appropriate; an area that cannot be leased is not a reasonable alternative to the Proposed Action.
599	Andy Radford, American Petroleum Institute et al.	Alternatives A and B are nearly identical with the exception of excluding areas from development and Alternative C is No Action. The Associations believe this does not represent a reasonable range of alternatives under NEPA due to the inability to substantially differentiate between Alternatives A and B and their associated environmental and socioeconomic effects presented in the Draft PEIS. The notion that the scope of the alternatives identified in the Draft PEIS will cover only those areas included in the DPP is fundamentally flawed. The Associations believe that BOEM has unnecessarily narrowed the scope of the Draft PEIS by deciding not to include any additional areas of the Eastern GOM Planning Area in the analysis of the Preferred Alternative in the 2017-2022 Program. We recognize that the DPP did not include this planning area due to the existing congressional moratorium; however, excluding the Eastern GOM Planning Area in the first stage of the multi-stage leasing program does not align with the intent of the long-term leasing process that is designed to take multiple factors into account and not pre-determine the outcome. Inclusion of this planning area in the 2017-2022 NEPA analyses does not require a subsequent decision by BOEM to hold a lease sale in the area.	The decisions associated with Program development necessarily narrow the Proposed Action and the realm of possible alternatives. It is not reasonable to analyze an alternative that cannot be selected by the Secretary. The portions of the Eastern Gulf of Mexico Planning Area not included in the Gulf of Mexico Program Area are under Congressional Moratorium and cannot be leased prior to 2022. Analysis of these areas as an alternative in the PEIS is not appropriate; an area that cannot be leased is not a reasonable alternative to the Proposed Action.

Comment ID	Commenter	Comment	Response
600	Andy Radford, American Petroleum Institute et al.	BOEM's approach to designing these programmatic alternatives should set a distinct course for decisionmaking whereby future NEPA compliance can effectively tier from the PEIS as more site-specific actions are considered. Specifically, the Associations request that BOEM include a chapter in the PEIS that describes: better documentation of the alternative screening process applied to a much broader range of alternatives, providing clear rationale for why certain options were eliminated or carried forward under an alternative; detailed procedures for future NEPA compliance on oil and gas lease sale activities in terms of the level of detail expected in future NEPA documents (i.e., local scale or regional scale) and additional opportunity for stakeholder engagement, etc.; actions planned or underway to address concerns raised during the PEIS such as closure areas, stakeholder coordination, etc.; and to provide an overview of additional activities related to evaluation of mitigation measures and monitoring to support successful management to "ensure a proper balance between oil and gas production, environmental protection, and impacts to the coastal zone" consistent with the OCSLA.	BOEM's approach to designing these programmatic alternatives sets the stage for future decisionmaking whereby future NEPA compliance can effectively tier from the PEIS as more site-specific actions are considered. Documentation of the screening process is provided in Chapters 1 and 2 of the PEIS. The dismissal discussion for alternatives not carried forward has been expanded and is presented in Section 2.7 of the Final PEIS. The phased approach BOEM takes to OCS leasing is shown in Figure 1.3-1 of the Final PEIS; opportunities for public input are also shown on this figure. BOEM regularly coordinates with stakeholders and will continue to do so both as a part of requirements under NEPA as well as through other methods. Mitigation measures are addressed as appropriate in this PEIS. Subsequent NEPA stages and consultation with Federal resource agencies provides an avenue for more detailed evaluation of mitigation measures and monitoring.
25	Anna Godduhn	Given our lack of ability to predict and mitigate disaster, it would be foolish to risk the treasures of the rugged and dynamic Arctic seas for the toxic and polluting fossil fuel industry that threatens the entire planet with threshold inducing climate change that is completely missing from this assessment.	BOEM has expanded the relevant resource sections to include additional information, as needed, on how the impacts of the Proposed Action could be further complicated due to climate change.
50	Anna Plager	The Draft PEIS does not give proper weight to the risks posed in Alaska by future offshore oil and gas development. Spill response in this climate is an unproven technology and we cannot afford the risks to our village communities. We implore you to consider extensive threats including but not limited to catastrophic oil spills and polluted waters.	The PEIS identifies and discusses the differences and challenges of spill response in the Alaskan environment in the Accidental Spills and Catastrophic Discharge Events Section, Chapter 4, dealing with ice, cold, and limited daylight conditions. Individual resources potentially impacted by a catastrophic discharge event (CDE), including those in Alaska, are discussed in the Potential Impacts per Resource Area Section, Chapter 4. This analysis of potential impacts is broad and considers entire planning areas. At subsequent lease sale stages, more specific information will be available regarding the location and level of activity, spill risk of proposed activities, and specific environmental resources in the area. At subsequent stages, BOEM might also conduct Oil Spill Risk Analysis modeling to better estimate spill risk, spill trajectories, and probability of contact with an environmental resource. Spill response methods and specifics would be analyzed in more detail in the individual lease sale stage environmental review documents as well as in spill response plans submitted as part of lessees' Exploration Plans and Development and Production Plans.

Comment ID	Commenter	Comment	Response
51	Anna Plager	The Alaskan coastal communities are the front line of impact recipients should an oil spill occur in this Arctic environment. They are dependent on the health and providence of the seas. Subsistence forms the core of these coastal communities in Alaska. Even the interior Alaskan communities are dependent on the health of the oceans -- there are no alternatives to the commerce for the villages unconnected by roads to the rest of the state, nation, and world. The free exchange of harvest from the land and sea is the economic basis for many of our Alaskan residents. We implore you to consider extensive threats to native cultures and subsistence lifestyles.	The Draft PEIS addresses these issues in Chapter 4, Sociocultural Systems and Accidental Spills and Discharge Events.
52	Anna Plager	The Draft PEIS does not give proper weight to the risks posed in Alaska by future offshore oil and gas development. The anadromous fish that wend their way into the heart of our State spend much of their lives at sea, so that any oil spill threats offshore directly impact the interior of our vast state. We implore you to consider extensive threats to migratory and anadromous species.	Multiple anadromous or migratory fish species are discussed in the Fish and EFH Sections of the PEIS (see Chapter 4 and Appendix C). For example, five salmon species (*Oncorhynchus* spp.) are discussed at the appropriate level of detail for a programmatic analysis. Analyses in this document are limited to federally managed species with designated EFH in the Arctic program areas. Therefore, BOEM has determined that no further discussion is necessary.
540	Anna Plager	The Draft PEIS does not give proper weight to the risks posed in Alaska by future offshore oil and gas development. I have not seen the economic analysis that truly reflects the down-stream effects of releasing more carbon into the atmosphere. Where is the cost-benefit analysis that balances oil and gas development against our clean air and water and our children's future?	The PEIS incorporates by reference and summarizes the net benefits analysis that is prepared in support of the Proposed Final Program. That approach is consistent with the provisions of 40 CFR 1502.23. The net benefits analysis does not include or quantify all potential benefits or costs as explained in the supplemental Economic Analysis Methodology report available at www.boem.gov. Costs considered include impacts to recreation, air quality, fisheries and subsistence harvests, and ecological damages. Non-use (passive use) and bequest value is also considered. BOEM has also prepared a new technical report that quantifies the potential downstream greenhouse gas emissions and the social cost of carbon associated with ongoing OCS Program and potential 2017-2022 Program oil and gas activities, including the consumption of oil and gas produced on the OCS. The technical report is referenced and summarized in the PEIS and other relevant Program documents and is available at www.boem.gov. The social cost of carbon is not incorporated into the net benefits analysis for the reasons described in the Economic Analysis Methodology report. The PEIS discloses the relationship between that net benefits analysis and separate social cost of carbon analysis.

Comment ID	Commenter	Comment	Response
448	Arnold Brower, Alaska Eskimo Whaling Commission	As the Program is finalized and implemented, it is critically important for BOEM and the Secretary of the Interior to make decisions only after robust and meaningful communication with our whaling captains and other community leadership in the high arctic region of the Bering Strait, Chukchi Sea, and Beaufort Sea. The AEWC greatly appreciates BOEM's recognition, as indicated in Alternative B, of the need for heightened protections in certain areas of the Beaufort and Chukchi Seas. The AEWC encourages BOEM to take advantage of the Open Water Season Conflict Avoidance Agreement process to provide coordinated stakeholder input for purposes of BOEM's decisionmaking. We do not believe that the creation of set-asides is appropriate at this juncture. Rather, the AEWC would prefer to see the question of special protections for EIAs addressed at the individual lease sale stage and in close consultation with our whaling captains and other community leaders.	As described in the PEIS, opportunities for public involvement included scoping meetings, Draft PEIS public meetings, and two public comment periods to solicit information and comments. BOEM coordinated meetings with Alaska Native community corporations and Alaska Native communities adjacent to the Alaska program areas to receive feedback and input on the proposed leasing activities. BOEM acknowledges existing measures to deconflict use of the Arctic OCS and appreciates the long history of coordination that has gone into making these efforts successful. In the Final PEIS, BOEM included how development of an Alaska Conflict Management Plan as a condition of plan approval could mitigate impacts.
449	Arnold Brower, Alaska Eskimo Whaling Commission	The AEWC also wishes to emphasize our whaling captains' support for offshore oil and gas development undertaken within the context of the Conflict Avoidance Agreement process. The pursuit of offshore oil and gas development through incorporation of the CAA Process and its consensus mitigation measures is precisely what is envisioned by the concept of integrated Arctic management (IAM) - to balance economic development, habitat protection, and cultural values. BOEM should therefore require participation in the CAA Process as a mitigation measure for all proposed alternatives in the PEIS.	The Conflict Avoidance Agreement process is administered by the National Marine Fisheries Service to mitigate impacts to subsistence resources as required under the Marine Mammal Protection Act. However, BOEM recognizes that a mechanism to facilitate communication and planning to reduce or avoid conflict is a valuable approach to mitigate potential impacts from oil and gas activities. This Final PEIS analyzes requirement of a Conflict Management Plan for the Alaska program areas that would facilitate coordination and communication between local communities and OCS oil and gas activities.
450	Arnold Brower, Alaska Eskimo Whaling Commission	To provide a more complete context of the importance of our subsistence activities, BOEM should provide additional information in the Final PEIS. In describing the sociocultural background against which oil and gas development is proposed, BOEM provides, in the Draft PEIS, a brief description of the importance of subsistence, citing studies by BOEM, Galginaitis, and Shell. We recommend that BOEM also review and reference: "Shawna BurnSilver et al., Are Mixed Economies Persistent or Transitional? Evidence Using Social Networks from Arctic Alaska, 118 American Anthropologist 121-29 (2016)". Dr. BurnSilver and her co-authors have conducted important research highlighting critical characteristics of the mixed and persistent cash/subsistence economies of our Alaska Native communities.	BOEM acknowledges the vital importance of social networks/community cooperation in subsistence harvests. BOEM has revised language in Chapter 4 to reflect this information and new references have been incorporated.

Comment ID	Commenter	Comment	Response
452	Arnold Brower, Alaska Eskimo Whaling Commission	The PEIS notes that industrial discharges to the water could affect subsistence harvests, but assumes that the impacts to our communities from discharges would be, at most, moderate. This conclusion apparently stems from the agency's assumption that sanitary wastes and other routine discharges will not persist in the water column, and will therefore not cause sociocultural impacts. Yet if these discharges occur during our subsistence whale hunt, whales may be deflected, making the hunt much more difficult and perhaps unsuccessful. An important measure protecting Beaufort Sea hunters within the CAA is the limitation on discharges in nearshore areas where food is taken and eaten directly from the water. These restrictions apply to drilling fluids, cuttings after setting of the 20" casing, treated sanitary and gray water, and ballast and bilge water. The AEWC strongly encourages BOEM to include these restrictions as a mitigation measure in the Final PEIS as part of the commitment to a CAA process.	The analysis of impacts associated with discharges is appropriate for a programmatic level analysis and text was added to the PEIS to address this. Impacts to subsistence are discussed in the Sociocultural Systems Section in Chapter 4. Additional site-specific analyses will be conducted if a lease sale occurs in the Beaufort Sea or Chukchi Sea Program Areas during the 2017-2022 Oil and Gas Leasing Program to further assess the potential impact of discharges into the water column. The Conflict Avoidance Agreement process is administered by the National Marine Fisheries Service to mitigate impacts to subsistence resources as required under the Marine Mammal Protection Act. However, BOEM recognizes that a mechanism to facilitate communication and planning to reduce or avoid conflict is a valuable approach to mitigate potential impacts from oil and gas activities. This Final PEIS analyzes requirement of a Conflict Management Plan for the Alaska program areas that would facilitate coordination and communication between local communities and OCS oil and gas activities.
453	Arnold Brower, Alaska Eskimo Whaling Commission	The AEWC recommends that BOEM incorporate the USEPA discharge limitations and other relevant CAA mitigation measures in its commitment regarding a CAA process for the Chukchi Sea corridor.	The Conflict Avoidance Agreement process is administered by the National Marine Fisheries Service to mitigate impacts to subsistence resources as required under the Marine Mammal Protection Act. However, BOEM recognizes that a mechanism to facilitate communication and planning to reduce or avoid conflict is a valuable approach to mitigate potential impacts from oil and gas activities. This Final PEIS analyzes requirement of a Conflict Management Plan for the Alaska program areas that would facilitate coordination and communication between local communities and OCS oil and gas activities.
454	Arnold Brower, Alaska Eskimo Whaling Commission	We recommend inclusion of a more detailed discussion of the increased vessel traffic in the Arctic, because it is a fundamental factor affecting current and future use of the Arctic Ocean. In addition, the impacts from shipping, including disturbance, introduction of invasive species, and discharges, pose the potential for threats to our bowhead whales, their habitats, and the continued success of our bowhead whale harvest. To address these potential impacts, the AEWC encourages BOEM to adopt the longstanding vessel transit guidelines of the CAA process we have requested in Final PEIS.	The PEIS has been revised. The PEIS addresses vessel traffic and its potential impacts on subsistence hunts in Alaska in the Sociocultural Systems Sections (Chapter 4); additional text has been added to the Final PEIS to provide details on potential impacts to subsistence target species from vessel traffic. More thorough assessments of vessel traffic impacts on bowhead whales and subsistence hunting will be included in Arctic region-, lease-, or activity-specific NEPA documents prepared by BOEM. The Conflict Avoidance Agreement process is administered by the National Marine Fisheries Service to mitigate impacts to subsistence resources as required under the Marine Mammal Protection Act. However, BOEM recognizes that a mechanism to facilitate communication and planning to reduce or avoid conflict is a valuable approach to mitigate potential impacts from oil and gas activities. This Final PEIS analyzes requirement of a Conflict Management Plan for the Alaska program areas that would facilitate coordination and communication between local communities and OCS oil and gas activities.

Comment ID	Commenter	Comment	Response
455	Arnold Brower, Alaska Eskimo Whaling Commission	BOEM acknowledges that oil and gas activities will result in disproportionately higher health or environmental impacts on Alaska Native populations, but simply concludes that "mitigation measures and government-to-government consultations with federally recognized Tribes are designed to limit the effects from routine events." Similarly, BOEM claims, "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." BOEM fails to specifically define the mitigation measures relevant to impact reduction and then fails to analyze their effectiveness. Without any explanation, it is difficult to understand how any proposed mitigation measures would effectively eliminate the sociocultural and environmental effects of offshore oil and gas development under the Program. To ensure that adequate mitigation measures are in place and/or developed, BOEM, in the Final PEIS, should require participation in the CAA Process to ensure adaptive management and mitigation and adopt the mitigation measures the AEWC has identified to reduce environmental justice impacts.	The level of analysis in the PEIS is in compliance with recent CEQ guidance on programmatic reviews (CEQ 2014) and is an appropriate level of detail for the decision at hand. The analysis is at a national level, and the scope of impacts is described broadly. If a decision is made to move forward with any of the proposed lease sales in the Proposed Five Year Program, additional reviews will take place that will be more site-specific and will analyze impacts on ESA listed and non-listed species in greater detail. Subsequent incremental NEPA documents will be written at the individual lease sale level. The Conflict Avoidance Agreement process is administered by the National Marine Fisheries Service to mitigate impacts to subsistence resources as required under the Marine Mammal Protection Act. However, BOEM recognizes that a mechanism to facilitate communication and planning to reduce or avoid conflict is a valuable approach to mitigate potential impacts from oil and gas activities. This Final PEIS analyzes requirement of a Conflict Management Plan for the Alaska program areas that would facilitate coordination and communication between local communities and OCS oil and gas activities. Determinations about specific mitigation measures and how they could be implemented generally occurs at the lease sale phase.
526	Arnold Brower, Alaska Eskimo Whaling Commission	BOEM should incorporate, as mitigation measures, certain long-standing provisions of Conflict Avoidance Agreements, including a Cross Island Deferral Area; restrictions on discharges in the Beaufort Sea where subsistence hunting takes place; a Chukchi Sea buffer zone; and vessel transit guidelines. By including the requirement for participation by offshore operators in the annual CAA Process, at the programmatic level, BOEM can ensure a process for identifying any necessary additional mitigation.	The analyses in the PEIS provide information to the decisionmaker and no outcome is presumed. The Conflict Avoidance Agreement process is administered by the National Marine Fisheries Service to mitigate impacts to subsistence resources as required under the Marine Mammal Protection Act. However, BOEM recognizes that a mechanism to facilitate communication and planning to reduce or avoid conflict is a valuable approach to mitigate potential impacts from oil and gas activities. This Final PEIS analyzes requirement of a Conflict Management Plan for the Alaska program areas that would facilitate coordination and communication between local communities and OCS oil and gas activities. Determinations about specific mitigation measures and how they could be implemented generally occurs at the lease sale phase.
527	Arnold Brower, Alaska Eskimo Whaling Commission	BOEM proposes a programmatic mitigation of an EIA in the Chukchi Sea nearshore lead system, which would "limit or modify activities during migration periods and until after the spring lead system has broken up and the sea ice has retreated." The AEWC has strongly supported this mitigation measure for some time, and we appreciate the agency's consideration of it in the new Program. However, we must request that inclusion of this measure be deferred until the lease sale stage, to allow more time for our Commissioners and whaling captains to work with BOEM on specifics.	The PEIS analyzes mitigation measures for this area. This information will be used to inform future decisions. The analyses provide information to the decisionmaker and no outcome is presumed.

Comment ID	Commenter	Comment	Response
528	Arnold Brower, Alaska Eskimo Whaling Commission	In the Environmental Justice analysis, BOEM notes that Alaska coastal communities could suffer major impacts from noise, construction, and offshore space-use conflicts. The overall cumulative impacts would also be major. The agency states that impacts to coastal communities from discharges that affect marine mammals would be moderate. However, discharges can have major impacts on our subsistence hunt as well. In addition to disturbing the whale migration, thus adversely affecting the availability of whales for harvest, the presence of waste related to industrial activities in the water gives rise to the potential for contamination of critical food sources.	Updated information specific to impact producing factors can be found in Chapter 4, Environmental Justice Section. A Human Health Effects Section has also been added to the PEIS in Chapter 4.
529	Arnold Brower, Alaska Eskimo Whaling Commission	In Table 3.5-1 in Chapter 3 (Draft PEIS), BOEM provides a summary of impact-producing factors (IPFs) associated with offshore oil and gas activities. Drilling mud, cuttings, and debris from G&G activities are not identified in the table. However, the EPA estimates that over 1.2 million gallons of drilling fluids and drill cuttings will be discharged each year from G&G activities. BOEM should include these discharges in its analysis of impacts to subsistence.	The PEIS was revised to correct impact producing factors. Discharge of drilling muds and cuttings may be possible with certain types of deeper stratigraphic test wells and geologic borings.
44	Barrow Meeting notes	Note that the service for the start of the whaling season took place on the same evening as the public meeting. Also, it is not appropriate to just seek public comment on BOEM planning documents - rather we should be involved in an integral way (such as in doing and presenting the analyses) from the beginning.	BOEM recognizes the scheduling issue noted by the commenter and the unfortunate timing of the Barrow public meeting in this instance, but in the future will continue to strive to schedule meetings to avoid potential conflicts. Given the long-term planning and scheduling required for the document preparation, release, and the public meeting process, BOEM had a narrow window of meeting availability for the North Slope communities. BOEM appreciates and welcomes the input of local communities to the leasing and impact assessment process. For the PEIS there were two public comment periods and numerous public meetings designed to solicit local input. Public meetings provided an opportunity to meet BOEM staff, to discuss issues of concern, and to make comment on the PEIS. Communities were also notified that they could submit comments via letter or the regs.gov docket during the 45-day review period for the Draft PEIS. BOEM notes that this level of involvement is appropriate at the programmatic stage, as it allows for identification of local issues and concerns. It also establishes a foundation for subsequent analysis, including agency coordination with local people, and detailed consideration of local issues, potential impacts, and feasible mitigation measures.

Comment ID	Commenter	Comment	Response
259	Brad Thomas, ConocoPhillips Alaska, Inc.	In the tabular summary of impacts, major impacts are identified only for impacts to Sociocultural Systems and Environmental Justice for Alternative A for the Beaufort Program. Based on our decades of experience with subsistence communities on Alaska's North Slope, we are firmly of the view that this summary is an oversimplification that improperly and negatively characterizes the potential impact of oil and gas development. Prior environmental analyses and actual history show that with respectful engagement and cooperation, oil and gas exploration and development can proceed in a manner that has broadly shared benefits and only modest potential impacts to subsistence activities. The summary conclusions in the PEIS reflect a superficial analysis of the potential impacts without the rigor required under NEPA to determine if the impacts may indeed be major.	The summary of impacts presents the high end of any range of potential impacts. The analyses in Chapter 4 provide more information and detail on the potential impacts associated with the Proposed Action. BOEM has determined that the impacts analysis is commensurate with the anticipated level of impacts for a programmatic EIS. BOEM will conduct more detailed analysis at the lease sale, exploration, and development phases. No change in text is needed. BOEM will continue to engage with stakeholders for consultation purposes.
260	Brad Thomas, ConocoPhillips Alaska, Inc.	BOEM should provide opportunity for operators to engage with local subsistence users. In comments on Lease Sale 242 (Beaufort), CPAI proposed one example of how this might be accomplished by the inclusion of a mitigation measure such as: "Permanent surface facility siting within six miles of Cross Island requires a determination by BSEE (or BOEM), in consultation with Nuiqsut Whaling Captains Association, that the development will not preclude reasonable access by subsistence hunters to whales during subsistence hunting." We continue to support a process based on collaboration rather than outright exclusion or exclusion by means of time and area restrictions.	BOEM acknowledges existing measures to deconflict use of the Arctic OCS and appreciates the long history of coordination that has gone into making these efforts successful. In the Final PEIS, BOEM included how development of an Alaska Conflict Management Plan as a condition of plan approval could mitigate impacts. Specific mitigation measures could be evaluated and identified at subsequent stages of the leasing process.
261	Brad Thomas, ConocoPhillips Alaska, Inc.	On a broader topic, we note that the Draft PEIS references new policies announced by the President and the Secretary of Interior in mitigation, and asserts that compensatory mitigation may be required under the OCSLA. CPAI sees an appropriate role for compensatory mitigation as part of a voluntary mitigation package for a proposed project, in some cases. But CPAI does not agree, outside the Clean Water Act, that compensatory mitigation can be broadly required or imposed for a project that meets criteria for approval adopted in compliance with governing statutes. We oppose the notion that BOEM has a regulatory structure to mandate compensatory mitigation payments in connection with lease sales or other components of a Five Year plan.	The Department's Mitigation Policy, which stems from the Secretarial Order and is fully in line with the President's Mitigation Memorandum, reaffirms the USDOI's authority and commitment to use landscape-level planning to implement the full hierarchy of mitigation, including compensatory mitigation when needed. Appropriately scaled analyses at later decision points for leasing, exploration, development, and production can best identify specific mitigation measures, including required compensatory mitigation measures. At all decision stages, coordination with State and Tribal governments as well as other Federal agencies, will help inform appropriate mitigation, including avoidance, minimization, and needed compensatory mitigation.

Comment ID	Commenter	Comment	Response
557	Brad Thomas, ConocoPhillips Alaska, Inc.	Untapped resources in the Arctic OCS are of critical economic importance to both Alaska and the United States. From an economic standpoint alone, promoting and fostering Arctic OCS development would represent a significant contribution to the national economy. Offshore development would also serve to help maintain the integrity of the Trans Alaskan Pipeline System (TAPS). Given the vast resources available in the Arctic OCS, future production could be the difference that extends TAPS operations for decades, allowing other existing fields to remain online.	The Population, Employment and Income Section (Chapter 4) addresses the potential economic, employment, and income benefits to that could be realized as a result of the Proposed Action. These estimates used BOEM's regional economic impact model (MAG-Plan) to produce the estimates of possible impacts. For additional information on the benefits and risks of the Alaska lease sales in the Proposed Program, see the Alaska OCS Region Benefits and Risks Section, of the accompanying 2017-2022 Outer Continental Shelf Oil and Gas Leasing Proposed Program Decision Document. The “equitable sharing” analysis includes discussions of increased wages, additional jobs, increased tax collections, and revenue sharing likely to result from the Alaska sales. Under the No Action Alternative (Alternative D) any potential socioeconomic benefits from the Proposed Action would not occur. The sale-specific Alaska EISs will provide additional socioeconomic impact analyses.
194	Brie Van Dam	However, it is even more critical that the PEIS take into account the climate impacts of consuming the fuels produced; this estimate needs to be included and highlighted in the PEIS since it is far larger than emissions from exploration/production alone. I would also encourage authors of the Draft PEIS to read the recent Nature article by McGlade and Ekins (2015) entitled "The geographical distribution of fossil fuels unused when limiting global warming to 2 degrees C" (doi:10.1038/nature14016). Other suggestions relating to updated estimates of sea-level rise and the effect of increasing greenhouse gas emissions include two 2016 studies (Hansen et al., 2016 in Atmospheric Chemistry and Physics, and DeConto and Pollard, 2016 in Nature).	The analysis has been expanded to include downstream consumption of oil and gas. The McGlade and Ekins (2015) and Hansen (2016) papers have been included in the analysis.
53	Cari-Ann Carty, Alaska Process Industry Careers Consortium	As part of the PEIS, it is imperative that BOEM fully consider potential employment and other economic benefits that would be associated with the exploration and development in the Arctic OCS.	Estimates of jobs generated and economic benefits such as labor and income that could occur in the Beaufort and Chukchi Program Areas as a result of the Proposed Action are discussed in the Population, Employment and Income Section. For more information on the benefits (and risks) of the Alaska lease sales in the Proposed Program, see BOEM's 2017-2022 Outer Continental Shelf Oil and Gas Leasing Proposed Program Decision Document. The "equitable sharing" analysis includes discussions of increased wages, additional jobs, increased tax collections, and revenue sharing likely to result from the Alaska sales. It also addresses environmental risks of the program proposal, as well as those of the energy substitutes that would most likely take the place of OCS production in the absence of the proposed lease sales (No Action Alternative).

Comment ID	Commenter	Comment	Response
46	Charlotte Basham	The PEIS does not adequately address the impacts of climate change. There are studies that are not cited in the PEIS, such as the 2015 report by McGlade and Ekins published in Nature, which states that fossil fuel extraction should be avoided in the Arctic region in order to keep our global temperature rise below 2 degrees Celsius. The Final PEIS should address the major 2016 study published by Atmospheric Chemistry and Physics which states that even a 2 degree temperature increase would likely result in sea levels rising an estimated 6-15 ft. by the end of the century. This would surely affect the status of offshore drilling. Emissions associated with exploration and development would release black carbon directly onto Arctic ice, thus speeding up the melting process. This effect should be taken into consideration.	On August 1, 2016, the Council on Environmental Quality issued Final Guidance for the Consideration of Greenhouse Gas Emissions and the Effects of Climate Change in National Environmental Policy Act Reviews. The Final PEIS quantifies downstream greenhouse gas emissions as a proxy for assessing climate change effects consistent with that guidance. BOEM has prepared a new technical report (available at www.boem.gov) that quantifies the potential downstream greenhouse gas emissions associated with ongoing OCS Program and potential 2017-2022 Program oil and gas activities. The two studies referenced by the commenter have been added to the discussion. In addition, the analysis of how climate change could exacerbate the impacts of the Proposed Action has been expanded where appropriate in the document.
47	Charlotte Basham	I am also concerned for the Native cultures in Alaska who depend upon subsistence activities for their livelihood. The PEIS does not adequately address the vital role these activities play in food security for these communities. Whales play a huge role in Iñupiat communities, both for food and as a key factor in their culture.	The PEIS addresses these issues in the Sociocultural Systems and Environmental Justice Sections in Chapter 4.
48	Charlotte Basham	Impacts upon fish are barely mentioned.	Impacts on Fish and Essential Fish Habitat are discussed in Chapter 4, Affected Environment and Impacts Assessment. The analysis is at a national level, and the scope of impacts is described broadly. The level of analysis in the current PEIS is in compliance with recent CEQ guidance on programmatic reviews (CEQ 2014) and is an appropriate level of detail for the decision at hand. If a decision is made to move forward with any of the proposed lease sales in the Proposed Five Year Program, additional reviews will take place that will be more site-specific and will analyze impacts to ESA listed and non-listed species in greater detail. Subsequent incremental NEPA documents will be written at the individual lease sale level.
116	Christin Anderson	A 2014 U.S. government report concluded that various oil spill control measures will be ineffective anywhere from 18 percent to 56 percent of the time during the summer drilling season. http://www.nukaresearch.com/files/140910_Arctic_RGA_Report_FNL.pdf	Reference text has been added to address the comment. It is not within the scope of the PEIS to analyze an oil spill response plan, including oil spill response methods and procedures. Oil spill responsibilities are required of offshore vessel and facility operators as part of the Oil Pollution Act of 1990.

Comment ID	Commenter	Comment	Response
117	Christin Anderson	As Shell Oil's attempts to drill exploratory wells and manage a logistically complex operation in 2012 demonstrated, oil companies cannot mobilize or operate in the Arctic safely. Shell's errors convincingly showed that the harsh conditions characteristic of offshore in Alaska and the complex demands of preparing for them predictably lead to the kinds of mechanical failure and human error that would thwart effective spill response. Interior has not implemented many recommended reforms, including developing Arctic-specific standards and requiring needed changes to blowout preventer designs and operation.	Sources and numbers of accidental spills evaluated in the PEIS were based on the estimated volume of oil production for each program area. The PEIS also discusses, in broad terms, a catastrophic discharge event (CDE) as a statistically unexpected, low-probability event. The Risk of a Low-Probability Catastrophic Discharge Event Section in Chapter 3 mentions recent improvements in well safety. Additional reforms regarding standards and operational design are under the responsibility of BSEE (www.bsee.gov). BSEE is responsible for inspections, enforcement, and safety of offshore oil and gas operations. Its functions include the development and enforcement of safety and environmental regulations, research, inspections, offshore regulatory programs, oil spill response, and training and environmental compliance programs. Discussion of accidental spills in the PEIS focused on event frequency and associated impacts, all within a programmatic context. More detailed analyses and considerations of well safety and recent improvements or BOEM/BSEE requirements will be addressed in subsequent lease sale EISs and project-specific documentation. No revisions to the PEIS are required.
118	Christin Anderson	The PEIS notes that more than 25 percent of respondents living in the Alaskan Arctic rely on subsistence for at least half of their food supply. Given the vital role it plays in the region, there is very little mention of it in the PEIS. For instance, there is no explanation of how anticipated impacts to wildlife would affect food security of area communities.	Text in the Sociocultural Systems Sections of the PEIS has been revised to include additional information regarding subsistence and food security.
119	Christin Anderson	The Sociocultural Systems section for the Chukchi and Beaufort Seas is very brief and lacks detailed information. Bowhead whaling is the only subsistence discussed, despite the importance of other subsistence resources, including bearded seal, beluga whale, and caribou--all of which would be directly affected by the proposed lease sales. Chukchi Sea communities south of Kivalina do not hunt for bowhead whales, but rely heavily on other resources such as bearded seal. The impacts to these communities are not adequately considered, and are never even mentioned in the Sociocultural Systems sections. Fish are also an important subsistence resource in the area but are mentioned only very briefly.	Text in the Sociocultural Systems Sections of the PEIS has been expanded per comment. The level of analysis in the current PEIS is in compliance with recent CEQ guidance on programmatic reviews (CEQ 2014) and is an appropriate level of detail for the decision at hand.

Comment ID	Commenter	Comment	Response
122	Christin Anderson	The proposed lease proximity to important biological areas for bowhead whales must be considered because the noise will displace animals from these sensitive areas and may interfere with important life functions.	Bowhead whales and their habitat in the Chukchi and Beaufort Seas are discussed and impacts evaluated in multiple sections of the PEIS, including the Affected Environment in Chapter 4 and Appendix C. Chapter 4, Impact Assessment, discusses potential impacts from the Proposed Action and alternatives, particularly noise and vessel traffic, on bowhead whale habitat and behavior. Additionally, analysis was done for the socioeconomic impacts from altered migratory and foraging areas as a result of the Proposed Action activities.
124	Christin Anderson	The PEIS fails to include key fish species in its analysis. These include burbot, char, grayling, and whitefish species. In fact, the Alaska Department of Fish and Game's Community Subsistence Information System includes subsistence harvest data collected within the past 10 years for Point Lay, Kivalina, and Noatak, all of which are on or near the Chukchi Sea and rely on fish stocks that would likely be affected by offshore oil development. Most of these species are anadromous and many occur in areas where offshore drilling is proposed. As such, they would be vulnerable to risks associated with offshore drilling, like those posed by oil spills spread by currents, wind, and ice across protection boundaries.	The level of analysis in the current PEIS is in compliance with recent CEQ guidance on programmatic reviews (CEQ 2014) and is an appropriate level of detail for the decision at hand.
126	Christin Anderson	According to the PEIS, subsistence fishing is important to communities bordering the program area, but it is believed that the majority of these activities occur in state waters; no landings data are currently available. The Alaska Department of Fish and Game, Division of Subsistence recently conducted baseline studies of nine communities in the Chukchi Sea and Norton Sound areas for the U.S. Fish and Wildlife Service-funded Coastal Impact Assessment Project, a baseline study related to offshore oil development. These data are forthcoming and should be included in the Final PEIS. Communities include Point Lay, Point Hope, Kotzebue, Noorvik, Deering, Shishmaref, Diomede, Golovin, and Stebbins.	The staged OCSLA process allows for BOEM to include additional information at subsequent NEPA stages. The level of analysis in the current PEIS is in compliance with recent CEQ guidance on programmatic reviews (CEQ 2014) and is an appropriate level of detail for the decision at hand.
128	Christin Anderson	By failing to consider downstream emissions from offshore oil and gas leasing, the Bureau of Ocean Energy Management (BOEM) is on shaky legal ground.	BOEM has expanded the climate change analysis to include downstream consumption of oil and gas.

Comment ID	Commenter	Comment	Response
131	Christin Anderson	Interior Department should analyze fully these climate costs of drilling in the Arctic Ocean, including the costs of burning any oil and gas produced and the black carbon consequences of exploring for, developing, and producing oil from Arctic waters.	On August 1, 2016, CEQ issued Final Guidance for the Consideration of Greenhouse Gas Emissions and the Effects of Climate Change in National Environmental Policy Act Reviews. The Final PEIS addresses the effects of climate change consistent with that guidance, including describing the sensitivity of resources to future impacts because of a changing climate. BOEM has also quantified downstream greenhouse gas emissions as a proxy for assessing climate change effects. CEQ regulations or the new guidance from CEQ do not expressly require the monetization of cost and benefits. BOEM has estimated the social cost of carbon in the separate technical report (available at www.boem.gov), and then summarized and referenced that broader analysis, as appropriate, in the PEIS or in other Program documents. Black carbon emissions, which the CEQ guidance does not address, are approximated through a conservative approximation of Fine Particulate Matter (PM2.5) in the Climate Change discussion (Issues of Programmatic Concern Chapter 4).
132	Christin Anderson	The PEIS acknowledges the difficulty of drawing definitive conclusions about the consequences of offshore oil development in relation to climate change: “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 […] and generalizations are best made at comparatively coarse scales” (C-23). Given this data gap, and the potentially severe stresses that the PEIS acknowledges climate change is causing or is expected to cause, there is not adequate information to ensure that offshore drilling can be conducted safely. Even in areas where impacts to ecological and/or social systems are expected to be minor or moderate, climate stresses could greatly exacerbate the consequences of stresses induced by drilling activities.	BOEM has expanded the analysis to include downstream consumption of oil and gas, and additional information on the Paris agreement. Additionally, BOEM has expanded the relevant resource sections to include additional information, as needed, on how the impacts of the Proposed Action could be further complicated due to climate change.
133	Christin Anderson	Climate change is stressing ice seals, including Arctic ringed seals. Ringed seals are the most ice-dependent of all ice seals and depend on sea ice and snow cover for essential life functions. Without sufficient sea ice and snow cover, ringed seals freeze to death or are eaten by predators. Studies have documented a nearly 100 percent mortality rate when snow cover was insufficient to build snow caves. Given these extreme stresses, added stress from offshore oil development even if it is considered "minor" or "moderate" in the PEIS may push ringed seal populations past breaking point.	The level of analysis in the current PEIS is in compliance with recent CEQ guidance on programmatic reviews (CEQ 2014) and is an appropriate level of detail for the decision at hand. The analysis is at a national level, and the scope of impacts is described broadly. If a decision is made to move forward with any of the proposed lease sales in the Proposed Five Year Program, additional reviews will take place that will be more site-specific and will analyze impacts on ESA listed and non-listed species in greater detail. This would include additional information on potential direct, indirect, and cumulative impacts to ringed seals if appropriate.

Comment ID	Commenter	Comment	Response
134	Christin Anderson	OCSLA specifically requires that oil exploration and production be balanced "with protection of the human, marine, and coastal environments." In keeping with this overarching goal, OCSLA expressly mandates that the Bureau reject a development and production plan when implementation of the plan "would probably cause serious harm or damage to the marine, coastal, or human environments when weighed against the extent of the threat and the potential advantages of allowing production." The Five Year Plan will likely cause a wide variety of serious harms to the environment, including the production of greenhouse gas emissions and other pollutants that will exacerbate climate change, oil spills that would be impossible to clean up, and impacts to already imperiled wildlife such as polar bears. The significance of these impacts clearly outweigh any purported benefits of the plan. This is true when the impacts are considered individually, and certainly when they are considered in the cumulative.	The analyses in the PEIS disclose the potential impacts associated with the activities that could occur if a schedule of leases for 2017-2022 is approved. This information, as well as the analyses in the Proposed Final Program document, are provided to the decisionmaker.
135	Christin Anderson	The coast of the Beaufort Sea is also an important denning habitat for polar bears. Experience with captive female polar bears suggests that they may be particularly sensitive to noise and disturbance during maternity denning.	Sound effects on marine mammals, including polar bears, is discussed in the Marine Mammals Section (Chapter 4) of the PEIS. Avoidance of active polar bear dens by prescribed distances have been shown to be an effective mitigation measure to avoid disturbance in the Beaufort and Chukchi Seas. This will be addressed in more detail at the next stage of NEPA review should either lease sale be selected to be held.
136	Christin Anderson	Proposed Chukchi Sea lease sales would require the eventual construction of a pipeline connecting to the Trans-Alaska Pipeline System (TAPS). "An additional 483 km (300 mi) of overland oil pipeline would have to be constructed to connect the Chukchi Sea OCS to TAPS at Prudhoe Bay." (Draft PEIS 3.1-2). Because this is a reasonably foreseeable outcome of Chukchi Sea oil and gas lease sales, the PEIS should include an analysis on the effect the pipeline will have on the resources and wildlife resources and their habitats mentioned here. This pipeline, and its accompanying service road, would cross the migration paths of at least three major caribou herds: the Western Arctic Herd, Central Arctic Herd, and Teshekpuk Herd. Pipelines and roads have been documented as having significant negative impacts on caribou migration and populations throughout the Arctic. All three of these herds are currently suffering declining populations and are experiencing stress due to climate change. Locals in Kotzebue and surrounding areas have noted the considerable impact that (relatively short) Red Dog Mine Road is having on Western Arctic Herd migration.	Text has been added to address comment at the programmatic level. More thorough analysis will be conducted in activity-specific NEPA documents. In addition, an analysis of Arctic Terrestrial Wildlife and Habitat has been added to the Final PEIS.

Comment ID	Commenter	Comment	Response
137	Christin Anderson	The PEIS does not address commercial fishing in state waters of Kotzebue Sound, in the Chukchi Sea. Commercial fisheries of adjoining Norton Sound, such as the snow crab fishery on the Seward Peninsula, are also not addressed.	Managed fish species and those with EFH in the Arctic program areas, including snow crab, are considered in Chapter 4 of the PEIS. More thorough assessments of commercial fisheries will be included in lease-, or activity-specific NEPA documents prepared by BOEM.
139	Christin Anderson	Seabirds are also threatened by oil spills because they tend to aggregate around offshore hydrocarbon drilling and production platforms. Seabirds aggregate around oil and gas platforms because they are attracted to light sources on the platforms, use the platforms as roost sites, or cue into higher food concentrations around platforms.	Potential impacts on birds are discussed in the Affected Environment, Impact Assessment, and Cumulative Impacts Sections of Chapter 4. A section on birds and potential impacts from Accidental Spills and Catastrophic Discharge Events is also included in Chapter 4. As stated in the PEIS, the level of impact would depend upon the timing, location, and size of a spill. Further analysis will occur at the lease sale level.
140	Christin Anderson	The PEIS fails to mention impacts of the Arctic oil leases nearby areas such as the Bering Sea. Ship traffic to and from the Arctic would pass through the Bering Sea. Shell’s previous oil leases included environmental impacts to the Bering Sea (Noble Lyc. convicted of dumping wastewater) and Gulf of Alaska (Kulluk grounded).	The impacts from vessel traffic are discussed in relevant resource areas in Chapter 4 and apply to all Program-related activities regardless of location.
141	Christin Anderson	The most significant cumulative effects of Five Year Plan are the greenhouse gas and other greenhouse pollutants that will be emitted as a result of the proposed plan. The Bureau must consider these impacts as part of its PEIS. Indeed, as the Ninth Circuit has made perfectly clear, “[t]he impact of greenhouse gas emissions on climate change is precisely the kind of cumulative impacts analysis that NEPA requires agencies to conduct.”	On August 1, 2016, CEQ issued Final Guidance for the Consideration of Greenhouse Gas Emissions and the Effects of Climate Change in National Environmental Policy Act Reviews. The Final PEIS addresses the effects of climate change consistent with that guidance, including describing the sensitivity of resources to future impacts because of a changing climate. BOEM has also quantified downstream greenhouse gas emissions as a proxy for assessing climate change effects.
142	Christin Anderson	In its PEIS, the Bureau must include an analysis of the economic impacts of the increased greenhouse gas emissions associated with the Five Year Plan. At least one court has specifically found that agencies may not avoid quantifying these costs in the NEPA context because “a tool is and was available: the social cost of carbon protocol.” The social cost of carbon (“SCC”) is an estimate of the economic costs associated with an increase in carbon dioxide emissions, developed by the U.S. Government’s Interagency Working Group on the Social Cost of Carbon. It is designed to estimate damages from climate change impacts, including changes in net agricultural productivity, human health, and property damages from increased flood risk.	On August 1, 2016, CEQ issued Final Guidance for the Consideration of Greenhouse Gas Emissions and the Effects of Climate Change in National Environmental Policy Act Reviews. The Final PEIS addresses the effects of climate change consistent with that guidance, including describing the sensitivity of resources to future impacts because of changing climate. BOEM has also quantified downstream greenhouse gas emissions as a proxy for assessing climate change effects. CEQ regulations or the new guidance from CEQ do not expressly require the monetization of cost and benefits. BOEM has estimated the social cost of carbon in a separate technical report (available at www.boem.gov), and then summarized and referenced that broader analysis, as appropriate, in the PEIS or other Program documents. BOEM has adopted the approach of the Interagency Working Group on Social Cost of Carbon to estimate the social cost of carbon.

Comment ID	Commenter	Comment	Response
143	Christin Anderson	With increasing ocean acidification, low-frequency sound travels much farther due to changes in the amounts of pH-dependent species such as dissolved borate and carbonate ions, which absorb acoustic waves. Under the pH change from a doubling of CO_2, which is expected to happen in the surface ocean by mid-century, sound at frequencies important for marine mammals will travel some 70% farther. Scientists have also found that increases in ocean temperature have the effect of decreasing sound absorption in the lower frequency range even more.	There will be changes in absorption and propagation due to acidification and warming ocean temperatures associated with climate change; however, low frequency sound already has very low absorption coefficient, and further reductions in absorption are expected to negligibly change overall sound propagation. For example, Udovydchenkov et al. (2010) modeled changes to noise at 199, 500, and 1,000 hertz at using predicted acidification levels for 2050 and 2100. The results showed only a 2 decibel increase. Udovydchenkov, I.A., T.F. Duda, S.C. Doney, and I.D. Lima. 2010. Modeling deep ocean shipping noise in varying acidity conditions. JASA Express Letters 128:EL130-EL136. http://dx.doi.org/10.1121/1.3402284
144	Christin Anderson	Bowhead whales use sound for navigation, communication and mating, and are known to have complex vocalizations during mating season. Bowhead whales are sensitive to low-frequency noise, such as that from large vessels and drilling. The proposed lease proximity to important biological areas for bowhead whales must be considered because the noise will displace animals from these sensitive areas and may interfere with important life functions.	The PEIS includes discussion of Biologically Important Areas in the Arctic Program Areas (Appendix C). Locations of leases are not known with any specificity at the programmatic stage. Additional analysis and potential mitigations could be considered at the lease sale stage.
145	Christin Anderson	Pacific walrus may also occur in the area and are sensitive to noise. Pacific walruses are easily disturbed by anthropogenic noise, making the increase in anthropogenic noise under water and in air from oil and gas development a cause for concern.	Sound effects on marine mammals, including walruses, is discussed in the Marine Mammals Section, Impacts Assessment, Chapter 4 of the PEIS. Avoidance of active walrus haul outs by prescribed distances have been shown to be effective mitigation measures to avoid disturbance in the Beaufort and Chukchi Seas. This will be addresses in more detail at the next stage of NEPA review should either lease sale be selected to be held.
147	Christin Anderson	As the document notes, many wildlife species are already under extreme stress due to climate change, with stress only expected to become more severe. Even in instances when impacts to wildlife is expected to be minor or moderate, climate stresses could greatly exacerbate the consequences of stress caused by offshore development.	The Final PEIS considers existing and reasonably foreseeable future trends or impacts from climate change in the context of each resource impact analysis as appropriate.
149	Christin Anderson	Despite an appendix that includes extensive details of the expected impacts of climate change on the affected environment surrounding the Chukchi and Beaufort Seas, in the Environmental Justice Section, the PEIS failed to note that Arctic offshore drilling will greatly exacerbate climate change by releasing an additional 15.8 billion tons of carbon pollution into the atmosphere. This is equivalent to the annual CO_2 emissions from 15,211 coal-fired power plants.	On August 1, 2016, CEQ issued Final Guidance for the Consideration of Greenhouse Gas Emissions and the Effects of Climate Change in National Environmental Policy Act Reviews. The Final PEIS addresses the effects of climate change consistent with that guidance, including describing the sensitivity of resources to future impacts because of changing climate. BOEM has also quantified downstream greenhouse gas emissions as a proxy for assessing climate change effects.

Comment ID	Commenter	Comment	Response
150	Christin Anderson	The 2017-2022 OCS PEIS states: “This PEIS was prepared using the best scientific information publicly available at the time of preparation.” However, it failed to cite the major 2015 study by McGlade and Ekins. The 2015 report by McGlade and Ekins and published in Nature highlighted the Arctic region as the one place on the planet that fossil fuel extraction should be avoided in order to keep our global temperature rise below 2°C. The Final PEIS should address the major 2016 study published by Atmospheric Chemistry and Physics (2016) [http://www.atmos-chem-phys.net/16/3761/2016/acp-16-3761-2016.pdf] which argues that even a 2°C temperature increase would likely result in a 6-15 ft. sea-level rise by the century’s end.	BOEM has incorporated the analyses from McGlade and Ekins, and Hansen into the PEIS, along with a brief discussion of how they relate to the emissions from the Proposed Action.
196	Christopher Lish	The focus of your report neglects to include any analysis of impacts from the end user of this oil that could come from the Arctic.	On August 1, 2016, CEQ issued Final Guidance for the Consideration of Greenhouse Gas Emissions and the Effects of Climate Change in National Environmental Policy Act Reviews. The Final PEIS addresses the effects of climate change consistent with that guidance, including describing the sensitivity of resources to future impacts because of changing climate. BOEM has also quantified downstream greenhouse gas emissions as a proxy for assessing climate change effects.
197	Christopher Lish	Much of the area you are considering for leasing overlaps with sensitive marine habitats that sustain wildlife and indigenous people, whose way of life is closely tied to healthy marine resources. Science shows that certain offshore areas—often those with durable physical or oceanographic attributes—make critically important contributions to the integrity and function of the larger ecosystem. Examples are long-established migration routes, foraging hot spots, subsistence use areas, rich seafloor habitat, lingering ice habitat, and areas where algae and phytoplankton thrive. We need to protect key areas of the Chukchi and Beaufort Seas that have high ecological value.	BOEM recognizes the importance and sensitivity of ocean and coastal habitats and species, as well as use of these areas by humans for recreation, work, and subsistence. This PEIS discloses the potential impacts of activities associated with oil and gas activities that may occur from leasing during the 2017-2022 Oil and Gas Program. The PEIS considers a number of ways to reduce or avoid impacts, including analysis of an alternative that considers exclusion of or mitigation for Environmentally Important Areas where there is the potential for conflict between environmental or sociocultural resources and the development of oil and gas.

Comment ID	Commenter	Comment	Response
199	Christopher Lish	The sensitive coastlines of the Arctic National Wildlife Refuge and the National Petroleum Reserve-Alaska could be greatly harmed, depending on the location and conditions in place at the time of a major oil spill.	In the PEIS, BOEM analyzed the potential impacts on the species and habitats that occur across the North Slope of Alaska, including those that occur in the Arctic National Wildlife Refuge (Arctic NWR) and the National Petroleum Reserve-Alaska (NPR-A). Should a lease sale occur in the Beaufort Sea, site-specific environmental analyses will be conducted that will, if applicable, more fully analyze the potential impacts on the Arctic NWR and NPR-A. Additionally, the Arctic NWR is considered a Marine Protected Area, as defined by Executive Order (EO) 13158. Including an impact analysis on this protected area in the PEIS fulfills BOEM's requirement under EO 13158 that each "federal agency whose actions affect the natural or cultural resources that are protected by an MPA shall identify such actions."
343	Cindy Shogan, Alaska Wilderness League	At the same time, BOEM should take a closer look at the best currently available science to determine if other areas of the Chukchi and Beaufort Seas could similarly be at risk from oil and gas activities. If BOEM does find these areas at risk, the agency should recognize those as EIAs as well.	BOEM undertook a rigorous process to identify and evaluate Environmentally Important Areas where there could be conflict between sensitive environmental or sociocultural resources and oil and gas development. There is always new information, including some submitted as comments on the Draft PEIS, which BOEM considers. BOEM will consider the EIAs and new information at each decision point and subsequent phase of the leasing process. New areas could be identified and evaluated at each phase.
344	Cindy Shogan, Alaska Wilderness League	Ignores the lack of technology and infrastructure that are necessary prerequisites to leasing.	Impacts associated with the presence or construction of infrastructure for oil and gas activities are analyzed in the PEIS, and estimated infrastructure (e.g., miles of pipeline, number of platforms) is included in BOEM's exploration and development scenarios (see full description in Chapter 3). Additionally, through the scoping process, BOEM actively solicited the most recent and available science/data necessary to effectively describe all potential impact pathways relevant to the Proposed Action. If a decision is made to move forward with any of the proposed lease sales in the Proposed Five Year Program, additional site-specific NEPA reviews will be conducted to analyze impacts in greater detail.

Comment ID	Commenter	Comment	Response
192	Colin Leach, Mulberry Well Systems LLC	The Draft PEIS may not accurately characterize the risk of occurrence of a catastrophic spill event. The risk assessment and underlying calculations are presented in Chapter 3 (p. 3-26 and p. 3-27). It is not clear if only OCS wells with sufficient reservoir potential to result in a catastrophic spill size (such as IXTOC, Macondo) were considered in the statistical analysis, or if all OCS wells and corresponding reservoir sizes (most of which could not lead to a catastrophic spill size in the first place) were part of the risk assessment. The implications of using wells that are not capable of producing a spill size may bias the risk assessment; the appropriateness of the approach should be confirmed.	Two peer-reviewed methods were used to characterize the spill of a catastrophic discharge. The extreme value approach uses historical spill data to estimate an extreme value probability distribution - that approach is independent of particular reservoirs. The other method (attributed to the 2012-2017 PEIS and The Bercha Group, 2014) does account for the number of wells drilled in a program. The approach determines risk by fitting a function to the observed spill sizes per aggregate wells drilled. As the PEIS describes, the full range of spill sizes considered may not be possible given the properties of a particular reservoir or well. Please refer to Anderson, Mayes, and Labelle 2012 for a detailed explanation of risk rates.
389	Colin Sheldon, Wildlife Conservation Society	BOEM's analysis of impacts to marine mammals is deficient. BOEM'S analysis in the Draft PEIS fails to address the latest published science on noise and marine mammals. The studies referenced in the Draft PEIS are only briefly described and existing studies relevant to the effects of received sound levels on various populations of marine mammals are omitted. These omissions prevent a complete analysis of this issue. As described below, there are multiple published articles on this subject that can provide additional clarity in BOEM's analysis.	BOEM acknowledges that, at the time of the composition of the Draft PEIS, documents referenced in the comment were not yet published. However, peer reviewed publications regarding impacts of seismic surveys on marine species up to the date of writing were included and therefore allow BOEM to complete the analysis of the issue as it pertains to activities considered in the PEIS using the best available science. The level of detail in describing these studies is appropriate for the PEIS document and can only address the activities considered under the PEIS. The current level of analysis is appropriate at the programmatic level, per CEQ guidance. More in depth and site specific information will be discussed at the lease sale level, should a lease sale occur.
390	Colin Sheldon, Wildlife Conservation Society	WCS is concerned that the acoustic environment description presented is overly simplistic and falls short of a complete analysis. It considers impacts from distinct sources individually and fails to consider the cumulative impact of several noise sources operating simultaneously. Also it only considers a few 1/3-octave frequency bands (e.g. 50 Hz for vessel and 50 + 100 + 200 Hz for seismic surveys). It is unclear why these particular frequency bands were chosen. WCS believes that the analysis should include frequency bands that are representative of the typical vocal frequency ranges from marine mammals present in each area to therefore make a better assessment of masking potential. Additionally, higher frequency energy has been described from airguns, as well as other oil and gas exploration and production noise sources; while higher frequencies may not propagate as far as lower frequencies, exposure to higher frequencies may impact marine mammals capable of detecting them.	The level of analysis in the PEIS is in compliance with recent CEQ guidance on programmatic reviews (CEQ 2014) and is an appropriate level of detail for the decision at hand. The analysis is at a national level, and the scope of impacts is described broadly. If a decision is made to move forward with any of the proposed lease sales in the Proposed Five Year Program, additional reviews will take place that will be more site-specific and will analyze impacts on ESA listed and non-listed species in greater detail. Subsequent incremental NEPA documents will be written at the individual lease sale level. These documents and analyses would consider acoustic impacts in more detail commensurate with a lease sale decision.

Comment ID	Commenter	Comment	Response
391	Colin Sheldon, Wildlife Conservation Society	BOEM failed to adequately consider the cumulative effects of impact-producing factors (IPFs) on marine mammals. In addition to evaluating the latest science regarding the impacts of noise on marine mammals, BOEM must evaluate the full scope of impacts to marine mammals from offshore oil and gas leasing, ranging from pre-lease exploration to decommissioning, and include a robust cumulative analysis. Although BOEM is considering relevant factors, the analysis of cumulative impacts in the Draft PEIS does not account for the full scope of effects that the Proposed Action could have on marine mammals. An improved analysis of this issue must not only include the best available science, but also a more thorough consideration of how all noise sources can influence marine mammals in a cumulative manner. In analyzing the potential impacts to marine mammals from noise, BOEM does not discuss the manner in which multiple noise sources can interact to create greater cumulative effect than when noise sources are viewed individually. WCS urges BOEM to include this analysis in the Final PEIS and suggests that sources such as Moore et al. (2012) can provide important information on this subject.	The level of analysis in the PEIS is in compliance with recent CEQ guidance on programmatic reviews (CEQ 2014) and is an appropriate level of detail for the decision at hand. The analysis is at a national level, and the scope of impacts is described broadly. If a decision is made to move forward with any of the proposed lease sales in the Proposed Five Year Program, additional reviews will take place that will be more site-specific and will analyze impacts on ESA listed and non-listed species in greater detail. Subsequent incremental NEPA documents will be written at the individual lease sale level. These documents and analyses would consider acoustic impacts in more detail commensurate with a lease sale decision.
394	Colin Sheldon, Wildlife Conservation Society	Additionally, to fully assess the potential for harm to marine mammals posed by the Proposed Action, BOEM must also consider the best available science outlining potential impact thresholds and the full range of effects from seismic surveys, both before and after the lease sale. An article published in Frontiers in Ecology and the Environment by Nowacek et al. in September 2015, entitled “Marine seismic surveys in ocean noise: Time for coordinated and prudent planning,” includes an assessment of the available scientific literature on impact thresholds and provides recommendations for assessing the cumulative impacts of multiple and prolonged exposures to seismic surveys. This assessment showed behavioral changes observed in marine mammals at levels below the 160 dB re 1 μPa (RMS) threshold for harm that has been used by BOEM in previous environmental analyses. This article also provides guidance that could be used by BOEM to operationalize this new information in its analyses. Consideration of these studies in the Final PEIS, along with a more complete analysis of relevant factors as described in the article, is essential to describe the potential impacts of the various noise sources from the Proposed Action.	BOEM acknowledges that, at the time of the composition of the Draft PEIS, documents referenced in the comment were not yet published. However, peer reviewed publications regarding impacts of seismic surveys on marine species up to the date of writing were included and therefore allow BOEM to complete the analysis of the issue as it pertains to activities considered in the PEIS using the best available science. The level of detail in describing these studies is appropriate for the PEIS document and can only address the activities considered under the PEIS. The current level of analysis is appropriate at the programmatic level, per CEQ guidance. More in depth and site specific information will be discussed at the lease sale level, should a lease sale occur.

Comment ID	Commenter	Comment	Response
395	Colin Sheldon, Wildlife Conservation Society	Finally, the analysis in the Draft PEIS analysis only briefly mentions behavioral disturbances to marine mammals caused by sound, and underemphasizes these impacts. BOEM states: “The larger question, as it relates to impacts to behavior and masking, is if and when these effects reach biologically significant levels. Determining where the potential exists for biologically significant reactions has been the focus of numerous studies, some funded by BOEM, but is still largely unknown.” Current work for example by the CetSound project, which is relevant to all OCS areas, was not mentioned in the Draft report and we strongly urge BOEM to include this highly relevant and important scientific research in the Final report, and to consider how the CetMap and SoundMap products and datasets could be utilized in the PEIS to better inform decisionmaking processes. Without a more thorough discussion of relevant studies and the progress made to date in understanding potential behavioral impacts, the Draft PEIS fails to provide the relevant information to consider all available scientific information.	The level of analysis in the PEIS is in compliance with recent CEQ guidance on programmatic reviews (CEQ 2014) and is an appropriate level of detail for the decision at hand. The analysis is at a national level, and the scope of impacts is described broadly. If a decision is made to move forward with any of the proposed lease sales in the Proposed Five Year Program, additional reviews will take place that will be more site-specific and will analyze impacts on ESA listed and non-listed species in greater detail. Subsequent incremental NEPA documents will be written at the individual lease sale level. These documents and analyses would consider acoustic impacts in more detail commensurate with a lease sale decision. BOEM continues to support research to better delineate impacts from anthropogenic noise.
396	Colin Sheldon, Wildlife Conservation Society	Next, BOEM must also consider the cumulative impacts of all of the relevant IPFs on marine mammals, in order to provide an accurate picture of how the potential effects of the Proposed Action can interact. Further, in developing the Final PEIS, WCS urges BOEM to conduct a more thorough analysis of the cumulative effects from the Proposed Action in combination with all past, present, and reasonably foreseeable actions. The Draft PEIS concludes that “[t]he cumulative impacts on marine mammals and sea turtles from all OCS and non-OCS activities are expected to be minor to moderate.” In its analysis, the Draft PEIS mentions relevant factors such as noise, entanglement, and changes in prey availability, but does not discuss the previous, current or projected magnitude of those impacts. Further, there is no mention of proven scientific methods for quantifying cumulative impacts on marine mammals and WCS strongly suggests that BOEM consider these. Maxwell et al. (2013) and Rosenbaum et al. (2014) developed a metric for quantifying the overlap between marine mammal distribution and a range of anthropogenic threats using a spatially explicit approach and these methods should be utilized for more accurately identifying areas and species at greatest risk. Additional information is necessary in the Final PEIS to understand how the cumulative impacts of the Proposed Action could affect marine mammals.	The level of analysis in the PEIS is in compliance with recent CEQ guidance on programmatic reviews (CEQ 2014) and is an appropriate level of detail for the decision at hand. The analysis is at a national level, and the scope of impacts is described broadly. If a decision is made to move forward with any of the proposed lease sales in the Proposed Five Year Program, additional reviews will take place that will be more site-specific and will analyze impacts on ESA listed and non-listed species in greater detail. Subsequent incremental NEPA documents will be written at the individual lease sale level. A more thorough site-specific analysis of cumulative impacts will be undertaken at the lease sale level, should a proposed lease move forward. BOEM incorporates the level of detail suggested by the commenter at the lease sale level if the information is available.

Comment ID	Commenter	Comment	Response
397	Colin Sheldon, Wildlife Conservation Society	BOEM underestimates the harmful impacts to marine mammals due to its incomplete noise analysis. The Draft PEIS states that "it is assumed that impacts to marine mammals from noise associated with routine operations may be negligible to moderate based on the source of noise (IPF), and the implementation and effectiveness of impact mitigation measures . . ." It also notes that "BOEM has identified impacts from sound (including impacts from particle motion) as an area of incomplete or unavailable information." Although particle motion impacts are a relatively new field, there is an ample body of work regarding the impacts of "pressure" sounds on marine mammals, for example, showing several kinds of impacts, on multiple species, some of which specifically resulted from seismic surveys. Further, the Draft PEIS separately assesses other IPFs in relation to marine mammals, without considering how all of these factors interact. As described in sections 1(a) and 1(b) above, BOEM's omission of relevant scientific evidence and factors in its analysis, as well as incomplete consideration of cumulative effects, leads to an inadequate consideration of the potential for harm to marine mammals, and likely understates the full impacts.	The level of analysis in the PEIS is in compliance with recent CEQ guidance on programmatic reviews (CEQ 2014) and is an appropriate level of detail for the decision at hand. The analysis is at a national level, and the scope of impacts is described broadly. If a decision is made to move forward with any of the proposed lease sales in the Proposed Five Year Program, additional reviews will take place that will be more site-specific and will analyze impacts on ESA listed and non-listed species in greater detail. Subsequent incremental NEPA documents will be written at the individual lease sale level. A more thorough site-specific analysis of cumulative impacts will be undertaken at the lease sale level, should a proposed lease move forward. In addition to the discussion of the Proposed Action, potential acoustic impacts on marine mammals, Appendix I, also describes mitigation measures that BOEM employs to avoid or minimize potential impacts.
398	Colin Sheldon, Wildlife Conservation Society	In the Final PEIS, BOEM should fully consider the cumulative impacts of offshore oil and gas development activities, including increased noise on marine mammals in this region -- using best available science and to consult with indigenous communities and tribes who will be affected by this action. It is critical that the economic viability of these communities be supported, while avoiding harm to fish, marine mammals, and other natural resources that they depend upon for subsistence purposes. WCS strongly encourages greater opportunities for local communities and their representatives to learn and understand the cumulative impacts of a busier and noisier coastal and marine environment.	The cumulative impacts analysis has been expanded with additional resource-specific evaluation for the Final PEIS. BOEM reviewed the most recent and best available science/data necessary to reasonably describe potential impact pathways and effects relevant to the Proposed Action. If a decision is made to move forward with any of the proposed lease sales included in the Program schedule, additional environmental review will take place before any individual lease sale. That review will consider in more detail impacts to North Slope communities and subsistence practices, as well as the species that are essential to the way of life. Subsequent reviews also provide the opportunity for additional public input and consultation with potentially affected Tribes.
273	Comment from 16 commenters	Industry has advanced state-of-the-art well control and response technology and systems that further minimize both the risk of a catastrophic oil spill and of potential environmental impact. BOEM should account for these improvements and advances.	Impacts of oils spills are discussed generally for the areas analyzed in this PEIS. These impacts are included in the Accidental Spills and Catastrophic Discharge Events Section (Chapter 4). If the program area has a lease sale, more detailed consideration of potential CDE impacts will be included.

Comment ID	Commenter	Comment	Response
114	Comment from two commenters (Christin Anderson and Princess Lucaj)	In early March, 2016, the Ninth Circuit Court of Appeals has upheld the designation of 187,000 square miles of the Arctic Ocean, the Bering Sea, and Alaska's northern coast as critical habitat for the polar bear. This habitat designation has not been considered in the 2017-2022 Five Year Plan.	This habitat designation was made after the release of the Draft PEIS. New figure and text have been added to the Final PEIS to address comment.
387	Community Advocate	This PEIS does not reflect the known adverse cumulative impacts of new offshore drilling.	The impacts of drilling have been discussed as part of the cumulative impact analysis under relevant resources such as marine benthic communities, pelagic communities, marine mammals and turtles, and fish and EFH.
388	Community Advocate	The PEIS should be modified and hearings conducted in each impacted parish and county.	Public meetings for the Draft PEIS were held in two locations along the Gulf coast - New Orleans, Louisiana, and Houston, Texas. Given the proposed leasing within the Western and Central Gulf of Mexico Planning Areas, BOEM determined that adequate geographic coverage of potentially affected coastal communities of the Texas, Louisiana, Alabama, and Mississippi coasts would be realized with two meetings in these locations. In addition, the Draft PEIS document was made available for review on the BOEM website; comments on the Draft document could also be submitted either in person or electronically at the public meetings, via mail, or to regulations.gov website during the 45-day comment period. Online access to the document and comment submittal opportunities either in person, online or via mail provided several mechanisms for public comment.
155	Crystal Polk	I am very concerned about the effects an oil spill would have in the Arctic Ocean. With the extreme weather conditions combined with the remote location responding to an oil spill in time would be almost impossible. One oil spill could be catastrophic.	The PEIS identifies and discusses the differences and challenges of spill response in the Alaskan environment in the Accidental Spills and Catastrophic Discharge Events Section, Chapter 4, dealing with ice, cold, and limited daylight conditions. Individual resources potentially impacted by a catastrophic discharge event (CDE), including those in Alaska, are discussed in the Potential Impacts per Resource Area Section, Chapter 4. This analysis of potential impacts is broad and considers entire Planning Areas. At subsequent lease sale stages, more specific information will be available regarding the location and level of activity, spill risk of proposed activities, and specific environmental resources in the area. At subsequent stages, BOEM might also conduct Oil Spill Risk Analysis modeling to better estimate spill risk, spill trajectories, and probability of contact with an environmental resource. Spill response methods and specifics would be analyzed in more detail in the individual lease sale stage environmental review documents as well as in spill response plans submitted as part of lessees' Exploration Plans and Development and Production Plans.

Comment ID	Commenter	Comment	Response
156	Crystal Polk	Finally, I am very concerned about the wildlife, especially polar bears, whales and seals but really all mammals will be affected. The disturbance of noise, vessels, aircraft, polluted water discharge, air pollution, bright lights, visible facilities such as platforms and pipelines will impede the migration of countless fish and mammals.	Chapter 4 of the PEIS presents the analysis of impacts on wildlife, including migration patterns. The current level of analysis is appropriate at the programmatic level, per CEQ guidance. More in depth and site specific information will be discussed at the lease sale level, should a lease sale occur.
90	Cyrus Reed, Lone Star Chapter, Sierra Club	In addition, you did not consider the use of downstream, refined products, or the use of this product in cars, trucks, industrial processes or refineries. That should have been considered.	On August 1, 2016, the Council on Environmental Quality issued Final Guidance for the Consideration of Greenhouse Gas Emissions and the Effects of Climate Change in National Environmental Policy Act Reviews. The Final PEIS addresses the effects of climate change consistent with that guidance, including describing the sensitivity of resources to future impacts because of a changing climate. BOEM has also quantified downstream greenhouse gas emissions as a proxy for assessing climate change effects.
91	Cyrus Reed, Lone Star Chapter, Sierra Club	Finally, I do not believe you have looked at the impacts of accidents on tourism, a major economic development tool of our region.	For this PEIS, a high level discussion of impacts from the Proposed Action on tourism and recreation are included in the Potential Impacts per Resource Area Section, Chapter 4. There is also a discussion of the potential impacts from an oil spill or CDE in the Accidental Spills and Catastrophic Discharge Events Section of Chapter 4. Should leasing under this Program move forward, additional analyses would be conducted before a lease is issued.

Comment ID	Commenter	Comment	Response
93	Cyrus Reed, Lone Star Chapter, Sierra Club	I question the assumptions in the PEIS about future use of oil. I would not rely upon EIA assumptions on the future use of oil. Just as they got future use of coal completely wrong, they are over-projecting the use of oil domestically.	BOEM recognizes that the future may bring new legal, policy, technological, energy efficiency, or other market changes that could ultimately affect U.S. demand for and supply of oil and gas. Further cuts in energy sector emissions are necessary to meet any of the emission reduction targets specified in the 2015 Paris Agreement and President Obama's 2050 climate goals. The U.S. Intended Nationally Determined Contributions (INDCs) is to reduce net (accounting for land use changes) greenhouse-gas emissions by 26-28% by 2025 (relative to 2005 levels). The U.S. INDC scenario does not assume “zero” oil and gas production or consumption in the future, but declining emissions from coal and oil. The U.S. has made notable progress towards its 2025 emissions reduction target through measures identified in President Obama’s Climate Action Plan. BOEM's analysis is predicated on the authoritative estimates of future energy demand from the U.S. Department of Energy, Energy Information Administration (EIA). While the commenter does not specify an alternative method for forecasting future demand or supply of oil and gas, or other sources of energy, BOEM does not speculate over the infinite pathways that could lead to carbon targets. For example, BOEM does not incorporate the World Energy Outlook or Conference of the Parties 21 “New Policies,” “Bridge,” “INDC,” or “450” scenarios that reflect very different pathways to meet global carbon-reduction targets. The 2017-2022 Program only proposes a schedule of potential oil and gas lease sales consistent with the requirements of OCSLA; a given program decision does not make an irretrievable commitment to hold the sales and does not guarantee oil and gas production or downstream consumption. Because of the protracted time frame (approximately 70 years) under consideration, it is even possible that production may not occur or could be greatly reduced at some point in the future given new laws or policies, or technologies or alternative sources of energy.
94	Cyrus Reed, Lone Star Chapter, Sierra Club	I also recognize the PEIS did address climate change to a certain extent -- both the climate change impacts of oil development and the impacts on oil infrastructure -- it is woefully inadequate.	On August 1, 2016, the Council on Environmental Quality issued Final Guidance for the Consideration of Greenhouse Gas Emissions and the Effects of Climate Change in National Environmental Policy Act Reviews. The Final PEIS addresses the effects of climate change consistent with that guidance, including describing the sensitivity of resources to future impacts because of a changing climate. BOEM has also quantified downstream greenhouse gas emissions as a proxy for assessing climate change effects.

Comment ID	Commenter	Comment	Response
95	Cyrus Reed, Lone Star Chapter, Sierra Club	You did not consider the use of downstream, refined products, or the use of this product in cars, trucks, industrial processes or refineries. That should have been considered.	On August 1, 2016, the Council on Environmental Quality issued Final Guidance for the Consideration of Greenhouse Gas Emissions and the Effects of Climate Change in National Environmental Policy Act Reviews. The Final PEIS addresses the effects of climate change consistent with that guidance, including describing the sensitivity of resources to future impacts because of a changing climate. BOEM has also quantified downstream greenhouse gas emissions as a proxy for assessing climate change effects.
96	Cyrus Reed, Lone Star Chapter, Sierra Club	I am also particularly concerned with the impacts on turtles in the gulf.	Impacts on sea turtles from the Proposed Action are evaluated in the PEIS. These impacts are covered in the Sea Turtles Section in the Impacts Assessment, Chapter 4, the Accidental Spills and Catastrophic Discharge Events, Chapter 4, and the Sea Turtles Section, Cumulative Impacts, Chapter 4.
438	David Klein	There is obviously insufficient current data on climate driven changes in marine currents, wind influences in sea ice, seasonal phenology in relation to 2015, 2016 observed changes of the above.	On August 1, 2016, CEQ issued Final Guidance for the Consideration of Greenhouse Gas Emissions and the Effects of Climate Change in National Environmental Policy Act Reviews. The Final PEIS addresses the effects of climate change consistent with that guidance, including describing the sensitivity of resources to future impacts because of changing climate. BOEM has also quantified downstream greenhouse gas emissions as a proxy for assessing climate change effects. The level of analysis in the PEIS is in compliance with recent CEQ guidance on programmatic reviews (CEQ 2014) and is an appropriate level of detail for the decision at hand. The analysis is at a national level, and the scope of impacts is described broadly. If a decision is made to move forward with any of the proposed lease sales in the Proposed Five Year Program, additional reviews will take place that will be more site-specific and will analyze impacts on ESA listed and non-listed species in greater detail. Subsequent incremental NEPA documents will be written at the individual lease sale level.
439	David Klein	Need more data in fish use and movements in the ice free water column especially in Chukchi and Beaufort Seas as it relates to the seasonal migration by salmon to and from Bering Sea and Mackenzie River and its entire lake and stream watershed.	The level of analysis in the PEIS is in compliance with recent CEQ guidance on programmatic reviews (CEQ 2014) and is an appropriate level of detail for the decision at hand. The analysis is at a national level, and the scope of impacts is described broadly. If a decision is made to move forward with any of the proposed lease sales in the Proposed Five Year Program, additional reviews will take place that will be more site-specific and will analyze impacts on ESA listed and non-listed species in greater detail. Subsequent incremental NEPA documents will be written at the individual lease sale level.

Comment ID	Commenter	Comment	Response
168	David McDowell	The secondary impacts of establishing an oil port here need to be evaluated. In particular, the lack of deep-water accessible shore-base infrastructure within the Arctic Region is sufficient reason not to support offshore development. There is no appropriate location for a deep-water port north of Cape Lisburne and eastward to the Canadian border. Prudhoe Bay is only accessible by shallow-draft barges to lighter supplies, and this was only made possible by construction of an "emergency" causeway which was further extended; likely without appropriate review of nearshore environmental impacts. The nearest possible port that could provide support is Dutch Harbor at Unalaska, which is over 1,400 miles from Barrow. Oil support facilities may be an incompatible use with this fishing-based community.	BOEM provided additional consideration of this comment in the Final PEIS. More thorough analysis will be conducted in activity-specific NEPA documents.
169	David McDowell	It is incorrect to state (Section 4.5.15, Draft PEIS) there is robust onshore oil and gas development in the Beaufort Planning Area and the sociocultural impact to nearby villages would be moderate. The only onshore production area is at Prudhoe Bay and is not adjacent to an established village. New developments outside the Prudhoe Bay area will have major impacts on nearby established communities.	The wording in the Sociocultural Systems Section in Chapter 4 has been clarified to indicate there is "existing" oil and gas activity onshore in the Beaufort Planning Area instead of "robust" activity.
170	David McDowell	Please note there are no existing facilities for Chukchi Sea offshore facilities to connect to (Page 3-13, line 4, Draft PEIS). The only onshore production area is at Prudhoe Bay and is not adjacent to an established village. New developments outside the Prudhoe Bay area will have major impacts on nearby established communities.	Text has been revised per comment.

Comment ID	Commenter	Comment	Response
171	David McDowell	These figures need to be adjusted to account for the low estimated new offshore pipeline miles presented in Table 3.1-1 and Table 3.1-2 (Draft PEIS). BOEM predicts production platforms and pipelines to be the source of approximately 7,800 barrels (bbl) spilled oil annually over an expected 40-year operation for the two possible Arctic Ocean leases. These are not low probability major events, but expected spill events of between 5 and 50 bbl, and between 50 and 1,000 bbl. These will result in acute short-term and chronic long-term catastrophic ecosystems impacts, but difficult to quantify. However, these estimates appear to be significantly under-reported if based on the number of platforms and miles of subsea pipeline. It is unreasonable to assume each of the estimated 25 platforms in the Beaufort Sea would only need 16 miles of new oil pipeline. This would have to assume all new platforms would be within 16 miles of currently accessible Prudhoe Bay facilities, or a single subsea pipeline will connect all platforms. For Chukchi Sea area leases, this assumes each of the six platforms would be within 20 miles of shore. This is most unlikely given the 25-mile exclusion zone.	Due to recent relinquishment of leases in the Chukchi Sea, the exploration and development scenario for the Proposed Action has been updated to include construction of new offshore and overland pipeline. In the Beaufort Sea, BOEM assumes that existing infrastructure at the time of development will be maximized to the extent possible to reduce new pipeline infrastructure. Moreover, each platform will not have pipelines connecting the platform to the shore. Platforms that are close to each other would be connected to a hub platform by short pipelines and then trunk pipelines from the hub platform would connect to existing facilities or network of pipelines that carry oil and gas to the shore or along the Beaufort coast. The Beaufort Sea area has existing onshore infrastructure which were factored into the development scenario. The corresponding table has not been revised. The estimated number of oil spills is not keyed to the actual volume of infrastructure, but rather the oil produced. Table 3.3-1 presents the assumed spill numbers over the life of the program, not on an annualized basis.
172	David McDowell	BOEM correctly assumes 300 miles of overland pipeline may need to be constructed if oil is to be delivered to Prudhoe Bay, though the feasibility and impacts of constructing such a pipeline are not addressed. Neither are the impacts of a possible offshore loading platform in the Chukchi Sea adequately addressed.	The PEIS assumed that onshore facilities would have been constructed to support activities on leases issued under Lease Sale 193. As this sale took place under a previous program, the impacts of that construction would not be covered in this PEIS. However, all but one of these leases was relinquished and that assumption no longer stands. The Final PEIS analyzes the potential impacts of infrastructure required to support OCS activities and does not assume that any infrastructure would be in place from leasing under previous programs. Text has been added to address this comment at the programmatic level. More thorough analysis will be conducted in activity-specific NEPA documents.
176	David McDowell	Figure 3.1-6 (Draft PEIS) presents an estimated 13 platforms in the Beaufort Sea in water depth greater than 25 m. BOEM considers some of these platforms to be bottom-founded structures (Page 3-9, line 17-18) (Draft PEIS) in water depths up to 100m. However, it is impracticable to consider any permanent structure in this area due to the Beaufort Gyre and moving pack ice.	BOEM appreciates the challenges of development in the Arctic and this will be further analyzed in lease sale and plan reviews before any construction begins.

Comment ID	Commenter	Comment	Response
177	David McDowell	The Draft PEIS states “Following lease termination or relinquishment, all facilities and seafloor obstructions usually are removed.” (Section 3.1.1.4. Line 4). This section suggests a high degree of noncompliance is acceptable. Before any lease sales are offered beyond the stamuki zone, industry must demonstrate their ability to adequately safeguard subsea pipelines from ice gouge damage. This should include a demonstration project that a trench can be excavated, a pipe placed and covered to be below the maximum probable ice gouge depth. Assuming the improbable development of offshore facilities in the Arctic, and to safeguard against ice gouge damage any pipeline in water less than 25 m should be removed within one year after cessation of operations.	All facilities and seafloor obstructions are removed below the mudline. Text in the Final PEIS has been revised per comment. The PEIS, as a programmatic document, provides a broad analysis of the projected levels of exploration, development, production, and decommissioning activities which result from leasing during the 2017-2022 period. More detailed analysis of site-specific issues and impacts, as well as regulatory compliance and safety, will be conducted in future lease sale EISs and specific project plans. The issue of safeguarding subsea pipelines in the Arctic would be considered at the lease sale stage, and would be evaluated as part of the applicable lease sale EIS.

Comment ID	Commenter	Comment	Response
298	David Turnbull, Oil Change International	Oil Change International's first area of comments are a direct response to Section 3.1, 'Greenhouse Gas Emissions' in the Draft Economic Analysis Methodology for the 2017-2022 Outer Continental Shelf Oil and Gas Leasing Program. The conclusion of this section is that emissions would be greater in the 'No Sale Option'. Our analysis shows that this conclusion is based on a flawed assumptions that stem from use of the AEO 2015 Reference Case as the basis for assessing the market for oil and gas in the United States during the period of production. The essential flaw lies in the Reference Case assumption that policies to reduce GHG emissions remain static over the forecast period. This leads to total U.S. energy related GHG emissions rising slightly over the forecast period (to 2040). If this were to transpire, the U.S. would miss its emissions reductions targets by at least 150 percent in 2040. The result of using the Reference Case is that expectations of domestic demand for oil and gas are much higher than they can possibly be if U.S. climate goals are successfully pursued. Put another way, using the Reference Case to assess climate impact is counterproductive because the Reference Case outcomes are directly counter to this government's goals for climate policy.	BOEM's economic analysis has been updated to reflect the EIA's Annual Energy Outlook 2016 Reference Case. Both the U.S. Department of Energy, Energy Information Agency and International Energy Agency anticipate a long-term need for oil and natural gas, with oil demand eventually declining and natural gas demand increasing. BOEM recognizes that the future may also bring new legal and policy, technological, energy efficiency, or other market changes that could ultimately affect supply and demand. Both the EIA (Annual Energy Outlook 2016) and IEA (World Energy Outlook 2015) indicate that strong climate policies do not obviate investment in oil and gas. Even if the U.S. moves decisively towards the demand and emissions trajectory implied by the IEA's 450 Scenario, large-scale investment in oil and gas remains an essential component of a low-cost transition to a low-carbon future. Recognizing this possibility, BOEM continues to work within the organizing principal of OCSLA which directs, subject to environmental safeguards, the expeditious development of OCS oil and gas resources. The PEIS does not speculate about how different climate policy measures could affect the nature of activities or activity levels under either the Proposed Action, or the No Action Alternative, if different climate strategies are pursued. BOEM does assume that oil and natural gas would be part of the future energy portfolio even if at lower levels. BOEM's analysis allows for a more direct comparison of impacts under the Proposed Action and No Action by using the same assumption set. The commenter implies that there is a limited need, or no need, for new oil and gas leasing in the time frame relevant to the Program and that new production and consumption is incompatible with climate targets. That assumption is flawed; the U.S. INDC and World Energy Outlook climate scenarios both recognize that undiscovered resources and reserves (in some moderation) can be produced and still meet climate pledges. Consistent with the requirements of OCSLA, the 2017-2022 Program only proposes a schedule of potential oil and gas lease sales consistent with the requirements of OCSLA; a given program decision does not make an irretrievable commitment to hold the sales and does not guarantee oil and gas production or downstream consumption. Because of the protracted time frame (approximately 70 years) under consideration, it is even possible that production does not occur or could be greatly reduced at some point in the future given new laws or policies, technologies or energy efficiency improvements, or more price-competitive alternative sources of energy.

Comment ID	Commenter	Comment	Response
299	David Turnbull, Oil Change International	BOEM should consider modeling the U.S. climate goal of an 83 percent reduction of emissions based on 2005 levels by 2050 in order to understand what domestic demand for oil and gas would be in a scenario in which the U.S. achieves this goal at a minimum. In addition, it is necessary to better understand whether the U.S. may actually need to reduce emissions further to achieve the temperature targets discussed in the Paris Agreement.	BOEM has revised the discussion on climate change in the PEIS to address emission reduction targets. BOEM addresses the Intended Nationally Determined Contributions (INDCs) that the U.S. delegation submitted to the United Nation under the Paris Agreement's framework. In addition, the new emissions estimates, which include downstream emissions are compared to both goals submitted to the UN for 2020 and 2025, as well as the longer-term goal by the Obama Administration to reach an 83% reduction by 2050. BOEM has not modeled the actual demand or supply changes, or possible pathways that could be necessary to achieve the targets. BOEM has not separately modeled future demand or corresponding consumption levels that would correspond to emission-reductions targets as that is outside the scope of this PEIS. Section 18 of OCSLA directs the preparation of a Five Year Program to meet the potential future energy needs of the Nation. The U.S. INDC scenario does not assume “zero” oil and gas production or consumption in the future, but declining rather emissions from oil. The U.S. has made notable progress towards its 2025 emissions reduction target through measures identified in the President’s Climate Action Plan. BOEM recognizes this possibility, but must also work within the organizing principal of OCSLA which directs, subject to environmental safeguards, the expeditious development of OCS resources. BOEM's analysis is predicated on existing laws and policies and uses the authoritative estimates of energy demand from the U.S. Department of Energy, Energy Information Administration (EIA) reference case. BOEM does not incorporate the World Energy Outlook or Conference of the Parties 21 “New Policies,” “Bridge,” “INDC,” or “450” scenarios that reflect very different pathways to meet global carbon-reduction targets. The 2017-2022 Program only proposes a schedule of potential oil and gas lease sales consistent with the requirements of OCSLA; a given program decision does not make an irretrievable commitment to hold the sales and does not guarantee oil and gas production or downstream consumption. Because of the protracted time frame (approximately 70 years) under consideration, it is even possible that production may not occur or could be greatly reduced at some point in the future given new laws or policies, or technologies or alternative sources of energy.

Comment ID	Commenter	Comment	Response
113	Dawn Winalski, The North Slope Borough	The North Slope Borough is writing to request a 60-day extension of both comment periods. The current comment periods overlap with an important time of the year for both subsistence activity and research. This makes it difficult for adequate review and meaningful participation by Borough staff and members of our communities.	On March 18, 2016, BOEM published a Notice of Availability of the Draft PEIS for the 2017-2022 Oil and Gas Leasing Program. NEPA requires a minimum 45-day comment period on Draft PEIS documents, a period which may be extended at the discretion of the agency issuing the document. In the case of the Five Year Draft PEIS, BOEM determined that 45 days was adequate and appropriate for a programmatic document. However, all stakeholders were encouraged to provide comments on the 2017-2022 Proposed Program during the comment period, which ended June 16, 2016. BOEM recognizes the importance of input from public stakeholders, and appreciates the timing constraints noted by the commenter.
345	Dawn Winalski, The North Slope Borough	Section 2.4.1., Reduced Proposed Action-Beaufort Sea Program of the Draft PEIS, enumerates exclusion for Cross Island Whaling; however, the Borough sees only one reference, Braund 2010, when noting distances that whalers must travel. The commenter provides 2 citations to be reviewed, evaluated, and referenced for this PEIS. [Galginaitis, M., 2009 and Galginaitis, M., 2013]	BOEM has updated this section in Chapter 2.
346	Dawn Winalski, The North Slope Borough	Need to include the most updated fish-related synthesis. [The commenter provided a reference, Logerwell et al. 2015, for review and inclusion in the PEIS.]	BOEM appreciates the additional information. The suggested literature was reviewed but BOEM determined that it does not provide additional information pertinent to the fish and EFH affected environment or cumulative impacts sections.
347	Dawn Winalski, The North Slope Borough	While it is typically stated in the Draft PEIS that individual projects add only small, incremental percentage to total cumulative impacts, and, therefore, may not be a detectable amount, please show that this is or is not the case for the sum of estimates (past, present through the next 40 year estimate) at the "regional level" (p. 4-1). Further, this PEIS states that "exact context and intensity of impacts from future OCS [...] activities" are difficult to make without specific details; however, it also states that there are "general impacts typical of offshore oil and gas and E&D that manifest regardless of where such activities occur (p 4-1). Since there are general impacts that have previously been noted in previous EISs, then these along with the present regional estimates may accumulate to where detection at a regional scale can be shown. If the analysis indicates that detection cannot still be determined, that finding should be noted as well.	The PEIS includes projections of emissions from the Proposed Action and cumulative OCS oil and gas activities in the Arctic; the Beaufort Sea Program Area is the only program area under which emissions are possible under past leasing, because there are no actively producing leases in the Chukchi Sea. Cumulative effects analyses need not consider past emissions unless those emissions are having a present-day or future effect on air quality. More thorough assessments of impacts on air quality will be included in region-, lease-, or activity-specific NEPA documents prepared by BOEM.

Comment ID	Commenter	Comment	Response
350	Dawn Winalski, The North Slope Borough	The commenter suggested BOEM include additional references regarding the dynamics of sea ice for review and inclusion in the coastal and estuarine habitats section and provided a list of citations. (Section 4.3.4.1. Page 4-32) (Draft PEIS).	The purpose of the affected environment section is to describe what is necessary at a broad scale to assess potential impacts to the resource. The literature suggested either is not pertinent to the impact discussion in the PEIS for this resource or does not add additional information to what is currently documented, including more recent literature in some cases. Therefore, BOEM does not find it necessary to make changes based on the references highlighted.
351	Dawn Winalski, The North Slope Borough	Page 4-36 Line 27: missing reference	Text has been revised per comment.
352	Dawn Winalski, The North Slope Borough	Draft PEIS, Section 4.4.2.2 Page 4-116 Lines 4-7. This does not sound right. The hard bottom habitat area they are referring to in Barrow Canyon area in Chukchi Sea and they still would be protected under the 25 mile buffer and the presidential withdraw areas.	The Barrow Canyon is in the Chukchi Sea and is considered an Environmentally Important Area (EIA) and is included as are the other area EIAs for impact discussions for each of the alternatives. Although much of Barrow Canyon will fall within the 25-mile buffer, as indicated in Table 3.5-2, there are eight geologic plays of undiscovered oil and natural gas development in the OCS Planning Area that overlap portions of Barrow Canyon. Potential impacts associated with this EIA are considered for applicable resource areas.
354	Dawn Winalski, The North Slope Borough	Draft PEIS, p. 4-160: Since non-OCS activities are considered in the cumulative impact scenario (4.5.4), the cumulative impact scenario for the Beaufort and Chukchi Seas would improve by examining and referencing Martha K. Raynolds, et al., Cumulative geoecological effects of 62 years of infrastructure and climate change in ice-rich permafrost landscapes, Prudhoe Bay Oilfield, Alaska, in Global Change Biology. 2014. Volume 20, Issue 4, pp. 1211-1224. This reference could also better inform two other sections: Land Use and Infrastructure, Oil and Gas infrastructure (Section 4.3.13.1, p. 4-58) and (Section 4.5.12, pp. 4-164-165).	The reference provided was reviewed and BOEM found that the characterization of activities and impacts is consistent with the principal conclusions therein. More thorough assessments of cumulative impacts on land use and infrastructure will be included in regional-,lease-, or activity-specific NEPA documents prepared by BOEM at later decision stages. Text is revised to incorporate material from the reference where appropriate.
355	Dawn Winalski, The North Slope Borough	Draft PEIS, Page 4-26: include references that list additional benthic invertebrate organisms and their environment of the Chukchi Sea: (comment includes list of suggested references)	Additional text has been added to the document and some of the suggested references have been included. These references provided additional common benthic organism family or species information. In keeping with the general level of detail currently contained in Chapter 4 for benthic communities, some of the references on more specific aspects of benthic marine ecosystems were not included.

Comment ID	Commenter	Comment	Response
356	Dawn Winalski, The North Slope Borough	Draft PEIS, p. 4-157 Section 4.5.1. Please clarify. It is stated that "Proposed Actions [PA] could impact air quality when added to other impacts from similar and unrelated past, present, and reasonable foreseeable future actions over the next 40 years"; however, Table 4.5.1-1 only appears to estimate air emissions from the PA, and does not appear to include past and present emissions. Please show the sum of past and present emissions/pollutants (based on previous PEIS documents that have noted emissions at regional level. These data and analysis would not constitute an "exorbitant" cost, CFR-1502.22).	The table described (Table 4.5.1-1) shows cumulative impacts, including the anticipated future emissions from existing and expected OCS operations. This includes BOEM's Proposed Action and historic actions, which will lead to future emissions of criteria pollutants. The text has been revised to reflect this. For a comparison, Table 4.4.1-1 presents only emissions from the Proposed Action.
27	Director Outreach & Programs, Operation HomeCare, Inc.	We are very concerned with the negative socio-economic impacts of the PEIS that are not addressed; lack of documented justification and alternative analysis. a) Lack public input in the decision making process. b) Does not address local impacts (too broad)	Socioeconomic impacts are considered primarily in the Population, Employment, and Income Section of the Final PEIS. This section provides an analysis of the impacts, whether positive or negative, that could occur under the Proposed Action and the alternatives. Public input was solicited at several stages of the development of the PEIS. BOEM issued a Notice of Intent (NOI) to prepare a PEIS for the 2017-2022 OCS Oil and Gas Leasing Program and requested comments for determining the scope of the PEIS. On the same date, BOEM issued a Notice of Availability (NOA) for the DPP. Scoping meetings were held in February and March 2015 in coastal state communities bordering the Mid- and South Atlantic and Western and Central Gulf of Mexico Planning Areas as well as in Alaska. An additional notice on March 6, 2015, announced that three additional scoping meetings would be held during March 2015 in coastal states bordering the Mid- and South Atlantic Planning Areas. After the meetings were completed, comments were analyzed for possible impacting factors, affected resources, and alternatives and mitigation ideas to help focus analyses and develop alternatives. Scoping comments were summarized in a scoping report made available on June 9, 2015, and posted online at www.boemoceaninfo.com. On March 18, 2016, BOEM published an NOA of the Draft PEIS for the 2017-2022 Oil and Gas Leasing Program and initiated a 45-day public comment period. BOEM sponsored a series of public meetings in March 2016 in Washington, D.C., New Orleans, and Houston and held 10 meetings in Alaska to solicit comments. There will be additional opportunities for public input during subsequent stages of the NEPA process. For this programmatic document, the focus is a broad analysis of possible impacts associated with implementing a Five Year leasing program. Additional site-specific analyses will occur during subsequent stages of the NEPA process.

Comment ID	Commenter	Comment	Response
29	Director Outreach & Programs, Operation HomeCare, Inc.	Does not address local impacts (too broad). Lack clear economic justification of new Gulf lease.	The level of analysis presented is appropriate for a programmatic EIS. More thorough assessments, including more details about local impacts will be included in lease-, or activity specific NEPA documents prepared by BOEM. The Purpose and Need of new leases in the Gulf of Mexico is presented in Chapter 1 of the PEIS.
31	Douglas Vincent-Lang	I do not think the Draft PEIS adequately analyzes benefits from offshore oil and gas development to Alaska and its communities. The benefits range from economic, cultural, and societal. The Draft PEIS also does not adequately address social justice considerations and impacts resulting from denying local people economic opportunities.	The PEIS analyzes the potential impacts to the various dimensions of culture and society in the Archaeological and Historical Resources, Land Use and Infrastructure, Commercial and Recreational Fisheries, Tourism and Recreation, Sociocultural Systems, and Environmental Justice Sections of Chapter 4. The Population, Employment and Income Section (Chapter 4) addresses the potential economic, employment, and income benefits that could be realized as a result of the Proposed Action. The analyses of the No Action Alternative in the Final PEIS discuss the sociocultural and socioeconomic consequences of no new leasing in Alaska. These estimates used BOEM's regional economic impact model (MAG-Plan) to produce the estimates of possible impacts. For additional information on the benefits (and risks) of the Alaska lease sales in the Proposed Program, see the Alaska OCS Region Benefits and Risks Section of the accompanying 2017-2022 Outer Continental Shelf Oil and Gas Leasing Proposed Program Decision Document. The "equitable sharing" analysis includes discussions of increased wages, additional jobs, increased tax collections, and revenue sharing likely to result from the Alaska sales.
15	Eileen Levandoski, Sierra Club Virginia Chapter	In particular, BOEM's Final PEIS needs to undertake, among other things, a comprehensive review to assess how to avoid leasing that would induce unnecessary environmental harm or wasteful investments in infrastructure that may be stranded as GHG limitations are implemented.	The Final PEIS analyzes the potential environmental impacts associated with leasing that may occur under the 2017-2022 Oil and Gas Leasing Program, including the impacts of infrastructure available or required to support activities that could occur. BOEM has expanded the climate change analysis to include downstream consumption of oil and gas, including additional discussions of U.S. and global commitments to mitigate climate change. Any investments in infrastructure are assessed by individual companies who might consider bidding on a lease sale; evaluation of whether certain investments are wasteful is beyond the scope of this document.
16	Eileen Levandoski, Sierra Club Virginia Chapter	In particular, BOEM's Final PEIS needs to undertake, among other things, a comprehensive review to avoid any leasing in areas that currently lack sufficient infrastructure to support drilling and production.	Impacts from the presence or construction of infrastructure for oil and gas activities is analyzed in the PEIS, and estimated infrastructure required for each program area (e.g., miles of pipeline, number of platforms) is included in BOEM's exploration and development scenarios (see full description in Chapter 3).

Comment ID	Commenter	Comment	Response
17	Eileen Levandoski, Sierra Club Virginia Chapter	In particular, BOEM's Final PEIS needs to undertake, among other things, a comprehensive review to decide how to maximize economic and environmental value from future federal leases, if any, while steadily reducing CO_2 and methane emissions in keeping with the world's agreement at Paris.	The Proposed Final Program analyses contain the discussion on the valuation of OCS leasing (http://www.boem.gov/Five-Year-Program/). BOEM has expanded the analysis on climate change to include downstream consumption of oil and gas resources, and describes the purpose and impacts of the Paris Agreement.
18	Eileen Levandoski, Sierra Club Virginia Chapter	In particular, BOEM's Final PEIS needs to undertake, among other things, a comprehensive review to encourage leasing and development of clean renewable energy – particularly solar and wind – both offshore and onshore, possibly linking fossil fuel leases to commitments to implement offsetting zero-carbon energy production.	Under OCSLA, the Department of Interior is required to determine an oil and gas lease sale schedule to best meet the nation's energy needs for 5-year periods. BOEM's Office of Renewable Energy is responsible for developing offshore renewable energy.
19	Eileen Levandoski, Sierra Club Virginia Chapter	In particular, BOEM's Final PEIS needs to undertake, among other things, a comprehensive review to consider that if any leasing continues, choose areas that minimize the local environmental harms that will result.	The PEIS provides an impact analysis to determine the level, extent, and scope of environmental impacts that could result from implementing the Proposed Action or any alternative. This information is provided to the decisionmaker.
20	Eileen Levandoski, Sierra Club Virginia Chapter	In sum, the PEIS needs to closely assess the need for, and impacts from, new leasing in light of modern climate science and the Paris Climate Agreement to dramatically constrain future greenhouse gas emissions.	BOEM has expanded the analysis on climate change to include downstream consumption of oil and gas resources and describes generally the purpose and impacts of the Paris Agreement.
21	Eileen Levandoski, Sierra Club Virginia Chapter	Downstream combustion of fossil fuels must be considered along with greenhouse gases from the production of fossil fuels. The scientifically-supported Paris Agreement means that (a) there is not a need to keep developing supplies at rates historically deemed acceptable; (b) business-as-usual production and combustion of fossil fuels would violate that agreement and cause potentially catastrophic harm to humans and the environment; (c) in addition, if leasing and development of fossil fuels continues without regard to limitations on permissible greenhouse gas emissions, both the U.S. economy and local economies linked to that fossil fuel development would suffer severe dislocation and stranded costs.	On August 1, 2016, the Council on Environmental Quality issued Final Guidance for the Consideration of Greenhouse Gas Emissions and the Effects of Climate Change in National Environmental Policy Act Reviews. The Final PEIS quantifies downstream greenhouse gas emissions as a proxy for assessing climate change effects consistent with that guidance. BOEM has prepared a new technical report (available at www.boem.gov) that quantifies the potential downstream greenhouse gas emissions and the social cost of carbon associated with ongoing OCS Program and potential 2017-2022 Program oil and gas activities.

Comment ID	Commenter	Comment	Response
24	Eileen Levandoski, Sierra Club Virginia Chapter	Downstream combustion of fossil fuels must be considered along with greenhouse gases from the production of fossil fuels. In particular, BOEM's Final PEIS needs to undertake, among other things, a comprehensive review to assess how much CO_2 and methane is likely to be released (from fossil fuel production, additional processing and transportation, and downstream combustion) as a result of existing leases for fossil fuel development on federal land, likely fossil fuel development on non-federal lands, and potential new leases on the OCS and other federal lands; quantify how much GHG emissions remain for the U.S. and the world to and beyond 2050, and how much new production is likely to be needed from OCS leases contemplated for 2017-2022; discuss and quantify the need for new leasing and production and the potential economic and environmental harm from failing to restrain future production of fossil fuels from federal offshore and onshore lands.	On August 1, 2016, the Council on Environmental Quality issued Final Guidance for the Consideration of Greenhouse Gas Emissions and the Effects of Climate Change in National Environmental Policy Act Reviews. The Final PEIS quantifies downstream greenhouse gas emissions as a proxy for assessing climate change effects consistent with that guidance. BOEM has prepared a new technical report (available at www.boem.gov) that quantifies the potential downstream greenhouse gas emissions and the social cost of carbon associated with ongoing OCS Program and potential 2017-2022 Program oil and gas activities. However, an analysis of carbon dioxide and methane emissions released from all oil and gas activities on all federal lands and non-federal lands is beyond the scope of this PEIS and would not provide for a meaningful distinction across alternatives. The same is true for quantifying the level of greenhouse gas emissions (related to OCS production) that can be emitted in the future and still meet emission-reduction targets. The environmental effects of greenhouse gas emissions and climate change are discussed in the Final PEIS.
274	Elizabeth Pomper, National Audubon Society; Christopher Lish	We need to protect key areas of the Chukchi and Beaufort Seas that have high ecological value. One such place is Harrison Bay, part of a globally significant Important Bird Area for Long-tailed Ducks, King Eiders, Red-throated Loons, Arctic Terns, Surf Scoters, Brant, and Glaucous Gulls. It's also a major migration staging area for Red-throated and Yellow-billed Loons and Spectacled and King Eiders.	Harrison Bay has been identified as an environmentally important area (EIA) in the PEIS, primarily for the protection of bird species. BOEM has determined that the impacts analysis discussion is commensurate with the anticipated level of impacts.
86	Emily Northrop	Of critical importance to the effects of extra emissions (at all stages related to fossil fuels) are the tipping points that the climate scientists are anticipating. It is hard to imagine how you can estimate the costs, let alone the incremental costs, of extra emissions given our scientific uncertainty about climate change tipping points. Please recognize that small additional emissions are bringing us ever closer to tipping points, and some incremental addition can push us over a serious tipping point.	On August 1, 2016, the Council on Environmental Quality issued Final Guidance for the Consideration of Greenhouse Gas Emissions and the Effects of Climate Change in National Environmental Policy Act Reviews. The Final PEIS addresses the effects of climate change consistent with that guidance, including describing the sensitivity of resources to future impacts because of a changing climate. BOEM has also quantified downstream greenhouse gas emissions as a proxy for assessing climate change effects.

Comment ID	Commenter	Comment	Response
87	Emily Northrop	You are assuming that if oil is not drilled from offshore, that it will be obtained from some other place. This is a highly problematic assumption if we are serious about remaining within 2 degrees C of global warming. We need to burn less fossil fuel. So please drop that assumption and base your analysis on comparing the offshore drilling to a curtailment of fossil fuel usage and emissions.	BOEM recognizes that the future may bring new legal, policy, technological, energy efficiency, or other market changes that could ultimately affect U.S. demand for and supply of oil and gas. The U.S. pledge, or Intended Nationally Determined Contributions (INDCs), is to reduce net (accounting for land use changes) greenhouse-gas emissions by 26-28% by 2025 (relative to 2005 levels). However, this U.S. INDC scenario does not assume “zero” oil and gas production or consumption in the future, but declining emissions from oil (and coal). The U.S. has made notable progress towards its 2025 emissions reduction target through measures identified in President Obama’s Climate Action Plan. BOEM continues to work within the organizing principal of OCSLA which directs, subject to environmental safeguards, the expeditious development of OCS oil and natural gas resources. BOEM's analysis is predicated on existing laws, regulations and policies and uses the authoritative estimates of future energy demand from the U.S. Department of Energy, Energy Information Administration (EIA) in its analysis. While the commenter does not specify an alternative method for forecasting future demand or supply of oil and gas, or other sources of energy, BOEM does not speculate over the infinite pathways that could lead to carbon targets. For example, BOEM does not incorporate the 2015 World Energy Outlook or Conference of the Parties 21 “New Policies,” “Bridge,” “INDC,” or “450” scenarios that reflect very different pathways to meet different carbon-reduction targets. The 2017-2022 Program only proposes a schedule of potential oil and gas lease sales consistent with the requirements of OCSLA; a given program decision does not make an irretrievable commitment to hold the sales and does not guarantee oil and gas production or downstream consumption. Because of the protracted time frame (approximately 70 years) under consideration, it is even possible that production may not occur or could be greatly reduced at some point in the future given new laws or policies, or technologies or energy efficiency improvements, or cost-competitive alternative sources of energy.
76	Eric Moll	This Environmental Impact Statement is completely non-scientific because of a disregard for the global impacts of climate change.	On August 1, 2016, the Council on Environmental Quality issued Final Guidance for the Consideration of Greenhouse Gas Emissions and the Effects of Climate Change in National Environmental Policy Act Reviews. The Final PEIS quantifies downstream greenhouse gas emissions as a proxy for assessing climate change effects consistent with that guidance. BOEM has prepared a new technical report (available at www.boem.gov) that quantifies the potential downstream greenhouse gas emissions associated with ongoing OCS Program and potential 2017-2022 Program oil and gas activities. Climate change is also discussed within resource sections, as appropriate.

Comment ID	Commenter	Comment	Response
77	Eric Moll	This Environmental Impact Statement is completely non-scientific because of a disregard for the global impacts of the utterly catastrophic consequences of a spill.	Determining global impacts of catastrophic discharge events (CDE) is beyond the scope of this PEIS. The PEIS evaluates and discloses, using scientific literature research and analysis, the potential impacts of accidental spills and a CDE for each of the resource areas that occur in the Program Areas considered in this PEIS.
320	Erik Grafe, Earthjustice	Rather than evaluate the Five Year Program decision in the context of this climate science and commitment, however, the Draft PEIS does the opposite—it ignores this commitment in a number of ways that distort the analysis and obscure the relevance of the Program decision to the effort to meet the climate commitment. First, it bases its evaluation of offshore leasing under the Program on an assumption that the nation will make no effort to meet its commitments to limit global temperature rise to 2 °C or less. Second, it declines to assess the climate consequences of consuming oil and gas extracted from the program areas under consideration. Third, it fails to assess the Program in the context of the significant impacts climate change will have on the program regions under consideration over the decades-long course of the Program, particularly in light of its business-as-usual assumptions which would project a global temperature increase of well over 2 °C by century's end. The Draft PEIS's failure to assess the decision in the context of climate science and the commitment to limit global temperature rise violates the National Environmental Policy Act (NEPA); robs the decisionmaker and public of information that is critically relevant to the decision of whether, where, and when to open additional areas of our oceans to fossil-fuel extraction; and skews the analysis in favor of offshore leasing.	BOEM has expanded the climate change analysis to include downstream consumption of oil and gas, including additional discussions of U.S. and global commitments to mitigate climate change. The expanded climate change discussion provides information to assist in meeting U.S. goals. Additionally, BOEM has expanded the relevant resource sections to include additional information, as needed, on how the impacts of the Proposed Action could be further complicated due to climate change.
321	Erik Grafe, Earthjustice	The Draft PEIS fails to analyze and describe in a useful way the regional differences in environmental effects of potential future oil and gas leasing and development across the regions it considers. In a number of ways, as a result, the Draft PEIS specifically downplays the potential effects of program activities on the Arctic Ocean program areas.	The PEIS provides an analysis of impacts between the OCS Program Areas. A comparison of impacts is captured in the PEIS Chapter 2, Summary of Impacts Anticipated from the Proposed Action and Alternatives. Chapter 4, Accidental Spills and Catastrophic Discharge Events, discusses the particulars of currents, hurricanes, and ice conditions that come into play for the different program areas.

Comment ID	Commenter	Comment	Response
322	Erik Grafe, Earthjustice	BOEM's business-as-usual forecast affects its analysis of impacts in at least two critical respects. First, it skews the analysis of impacts in the Draft PEIS toward offshore leasing. This is because BOEM concludes that the No Action Alternative would have more serious environmental consequences than the action alternatives. However, in a future scenario in which demand for oil and gas did not follow a business-as-usual trajectory— for example if the nation takes measures to meet its climate commitments by sharply limiting the amount of greenhouse gases that can be emitted into the atmosphere—there may be less need for oil and gas. In these scenarios, there could be fewer or no substitute fossil fuels developed if the Program does not schedule new leases, and the No Action Alternative may well pose fewer environmental risks and costs. Indeed, in these lower-carbon futures, there may be no room for additional, as-yet unproven fossil fuels from onshore or offshore, and future offshore leasing may thus not best meet energy needs. Thus, BOEM's reliance solely on the business-as-usual forecast improperly skews the analysis in favor of drilling and overstates the environmental risks and impacts of the No Action Alternative, putting a thumb on the scale in favor of including future lease sales in the Program.	The PEIS provides an objective assessment of the potential effects of the Program and possible energy substitutes that may occur under the No Action Alternative. Both the U.S. Department of Energy, Energy Information Agency and International Energy Agency anticipate a long-term need for oil and natural gas, with oil demand declining and natural gas demand increasing. BOEM recognizes that the future may also bring new legal and policy, technological, energy efficiency, or other market changes that could ultimately affect supply and demand. Both the EIA (2016 Annual Energy Outlook) and IEA (World Energy Outlook 2015) indicate that strong climate policies do not obviate investment in oil and gas. Even if the U.S. moves decisively towards the demand and emissions trajectory implied by the IEA's 450 Scenario, large-scale investment in oil and gas remains an essential component of a low-cost transition to a low-carbon future. Recognizing this possibility, BOEM continues to work within the organizing principal of OCSLA which directs, subject to environmental safeguards, the expeditious development of OCS oil and gas resources. The PEIS does not speculate about how different climate policy measures could affect the nature of activities or activity levels under either the Proposed Action, or the No Action Alternative if climate strategies are pursued. BOEM does assume that oil and natural gas would be part of the future energy portfolio even if at lower levels. BOEM's analysis allows for a more direct comparison of impacts under the Proposed Action and No Action by using the same assumption set. The commenter implies that there is a limited need, or no need, for new oil and gas leasing in the time frame relevant to the Program and that new production and consumption is incompatible with climate targets. That assumption is flawed; the U.S. INDC and World Energy Outlook climate scenarios both recognize that undiscovered resources and reserves (in some moderation) can be produced and still meet climate pledges. Consistent with the requirements of OCSLA, the 2017-2022 Program only proposes a schedule of potential oil and gas lease sales consistent with the requirements of OCSLA; a given program decision does not make an irretrievable commitment to hold the sales and does not guarantee oil and gas production or downstream consumption. Because of the protracted time frame (approximately 70 years) under consideration, it is even possible that production does not occur or could be greatly reduced at some point in the future given new laws or policies, technologies or energy efficiency improvements, or more price-competitive alternative sources of energy.

Comment ID	Commenter	Comment	Response
323	Erik Grafe, Earthjustice	BOEM's reliance on the single, business-as-usual forecast causes the agency to violate NEPA's alternatives requirement. NEPA requires consideration of a reasonable range of alternatives that meet the action's Purpose and Need. This obligation requires an agency to consider all reasonable and viable alternatives. BOEM has rejected consideration of any alternatives in which renewable energy would replace some or all of the offshore oil and gas from program area lease sales on the basis that such alternatives are not viable to meet energy needs. As support for this conclusion, BOEM cites the market-substitution analysis that relies on the business-as-usual energy needs assumption. Had BOEM considered other potential energy trajectories, as NEPA requires, it would have to assess these alternative-energy alternatives, because they might well meet future energy needs. These alternatives would offer the decisionmaker a range of program choices based on different assumptions about how the nation will get its energy in the coming decades.	Section 18 of OCSLA does not call for the development of a national energy strategy that prescribes the use of various energy sources or energy efficiency improvements. Rather, Section 18 calls for the Secretary of the Interior to decide what areas of the OCS (if any) should be offered for oil and gas leasing and when, consistent with Congressional direction to expeditiously develop oil and natural gas resources. Therefore, the PEIS need only analyze alternatives of size, timing and location for oil and gas leasing provided there is a continued need for oil and gas. Both the U.S. Department of Energy, Energy Information Agency and International Energy Agency anticipate a long-term need for oil and natural gas, with oil demand eventually declining and natural gas demand continuing to increase. BOEM recognizes that the future may bring new legal and policy, technological, energy efficiency, or other market changes that could ultimately affect supply and demand. That being said, both the EIA (Annual Energy Outlook 2016) and IEA (World Energy Outlook 2015) indicate that strong climate policies or measures do not obviate the need for continued investment in oil and gas. Even if the U.S. moves decisively towards the demand and emissions trajectory implied by the IEA's 450 Scenario, large-scale investment in oil and gas remains an essential component of a low-cost transition to a low-carbon future. BOEM has considered the implications of not leasing in the No Action Alternative; BOEM considers other energy sources that may be substituted as a means to address energy demand or as a means to avoid or minimize direct or indirect impacts, including the partial substitution of renewable energy. BOEM presumes that renewable energy would not replace all of the oil and natural gas that could be produced from the OCS. BOEM does use forecasts from the U.S. Energy Information Administration (e.g., 2016 Annual Energy Outlook, Reference Case) to estimate future energy demand and its MarketSim model to identify the most likely sources of energy to meet that demand. BOEM recognizes that further cuts in energy sector emissions are necessary to meet the emission reduction targets specified in the 2015 Paris Agreement and President Obama's 2050 climate goals, including methane emissions related to oil and gas production.
324	Erik Grafe, Earthjustice	A lawful assessment of the climate consequences of the Program will require analysis of how opening the program areas to fossil-fuel extraction comports with the nation's climate commitment and scientific consensus about an overall carbon budget.	BOEM has expanded the climate change analysis to include downstream consumption of oil and gas including additional discussions of U.S. and global commitments to mitigating climate change. BOEM has expanded the relevant resource sections to include additional information, as needed, on how the impacts of the Proposed Action could be further complicated due to climate change.

Comment ID	Commenter	Comment	Response
325	Erik Grafe, Earthjustice	Burning oil and gas from the program areas is a reasonably foreseeable consequence of any program that schedules leases. In addition to assessing the development of program area oil and gas in the context of the carbon budget, BOEM should also address how introducing this fossil fuel into the market will affect overall consumption and the resulting greenhouse gas emissions.	BOEM has expanded the climate change analysis in the Final PEIS to include downstream consumption of oil and gas, including additional discussions of U.S. and global commitments to mitigating climate change. Additionally, BOEM has expanded the relevant resource sections to include additional information, as needed, on how the impacts of the Proposed Action could be further complicated due to climate change.
326	Erik Grafe, Earthjustice	Another document, the Draft Economic Analysis Methodology, which is a supplement to the Proposed Program analysis, contains a brief conclusion that BOEM “does not consider the impact of the consumption of any of the fuel sources as they are assumed to be roughly equivalent under both the Program and No Sale Option.” To the extent BOEM relies on this conclusion to avoid assessing the climate effects of program oil and gas consumption, it would have to set forth this conclusion in the PEIS and justify it since NEPA requires an assessment of the climate impacts of end-use oil and gas.	The Economic Analysis Methodology report describes the methods used by BOEM to prepare the net benefits analysis for the Program analysis. Pursuant to 40 CFR 1502.23, the net benefits analysis is incorporated by reference into the PEIS. On August 1, 2016, the Council on Environmental Quality issued Final Guidance for the Consideration of Greenhouse Gas Emissions and the Effects of Climate Change in National Environmental Policy Act Reviews. BOEM has prepared a separate technical report (available at www.boem.gov) that estimates upstream and downstream emissions in context of ongoing OCS Program oil and gas activities. The Final PEIS incorporates by reference and summarizes that analysis, comparing potential differences in greenhouse gases under the Proposed Action and No Action Alternative.

Comment ID	Commenter	Comment	Response
327	Erik Grafe, Earthjustice	BOEM assumes that OCS oil and gas forgone under a No Action option would be replaced by increased oil imports, increased onshore gas production, and other fuel substitutions. In its MarketSim model, forgone program oil and gas would result in an average 7% reduction in consumption. BOEM concludes that some forgone offshore oil and gas would be replaced by higher-carbon fuels like coal and imported oil transported by tankers, and the additional emissions from these replacements would offset the emissions savings from reduced consumption. As a result, BOEM concludes the greenhouse gas emissions from the No Action Alternative would be roughly equal to those of the action alternative. The MarketSim model is based on an untenable business-as usual assumption and its conclusions might be different if different market assumptions assuming a lower-carbon scenario are applied. BOEM presents the results of the modeling in a flawed and highly misleading manner. MarketSim describes that “oil is modeled as a global market,” and BOEM even acknowledges that “[greenhouse gases] are global pollutants”. However, in describing the effects that program oil and gas would have on the market, BOEM discloses only how domestic consumption will respond to increased or decreased offshore oil supply. Thus, the average 7% reduction in consumption if the program excludes OCS leasing represents only reduced domestic oil and gas consumption. As a recent analysis from the Stockholm Environment Institute (SEI) demonstrates, excluding the international market effects dramatically understates how OCS leasing will affect consumption and therefore greenhouse-gas emissions. This is because, according to BOEM’s analysis, the United States would import less oil if oil were introduced into the market from the OCS. As a result, more oil would be available in the world market outside the United States. This increased oil supply would result in increased consumption abroad, with corresponding increased greenhouse gas emissions. The same would be true in reverse—by not introducing OCS oil into the market, the United States would import more oil from abroad, which would reduce supply abroad, with corresponding reduced greenhouse gas emissions. According to the SEI’s analysis, which used the same assumptions as BOEM does in its MarketSim model, counting only domestic consumption and greenhouse gas effects understates the effects by as much as a factor of ten. BOEM’s exclusion of any discussion of these market effects on consumption abroad and corresponding emissions is misleading, undermines its conclusion that net effects of greenhouse gas emissions will be the same whether the program schedules OCS leases or not, and violates NEPA.	The comment requests that BOEM consider different energy baseline scenarios other than the U.S. Department of Energy Information Administration’s Annual Energy Outlook (EIA AEO) and revise the substitutions assumptions used in BOEM's MarketSim model to account for consumption impacts at a domestic and global level. By failing to do so, the commenter asserts that BOEM’s analysis underestimates the net effects of greenhouse gas emissions attributable to the Five Year Program. The analyses prepared for the Proposed Final Program (PFP) and supporting Program documents are based on Reference Case projections from the EIA's 2016 AEO. The EIA’s energy demand estimates are the official U.S. Government estimates and are appropriate to include in this analysis. The 2016 AEO Reference Case reflects the effects of existing laws and regulations on the fuel consumption and greenhouse gas emissions of vehicles, including the Clean Power Plan, which is designed to limit carbon dioxide emissions at existing fossil-fired electric power plants. However, the Reference Case does not speculate about future law and regulations that may be necessary to meet carbon-reduction targets. BOEM does not base its analysis on special cases. To forecast a different set projections would require considerable assumptions as to how the Nation might achieve lower consumption and emissions goals, and these assumptions would drive our results. Instead, BOEM has addressed the issue of world-wide substitution effects in the PFP and Final Economic Analysis Methodology report. The Net Benefits Analysis is framed on national needs and resources consistent with Section 18 of OCSLA. The Net Benefits Analysis focuses on domestic effects and does not include international effects, including price-induced benefits (consumer surplus) experienced by non-U.S. consumers, dividends received by non-U.S. citizens, and environmental and social costs borne by non-U.S. citizens. BOEM continues to explore new ways to analyze and incorporate trans-boundary and global costs to provide supplemental information to our analysis. In addition to discussion in the PFP and Final Economic Analysis Methodology report, BOEM has prepared a new technical report (available at www.boem.gov) that quantifies the potential downstream greenhouse gas emissions and the social cost of carbon associated with ongoing OCS Program and 2017-2022 Program oil and gas activities and consumption of oil and gas produced on the OCS.

Comment ID	Commenter	Comment	Response
328	Erik Grafe, Earthjustice	As part of its assessment of climate change, BOEM should use available tools to determine the costs of carbon pollution. One such tool is produced by the Interagency Working Group on Social Cost of Carbon. It has produced estimates for the social cost of carbon in order to "allow agencies to incorporate the social benefits of reducing carbon dioxide (CO_2) emissions into cost-benefit analyses of regulatory actions that impact cumulative global emissions." The working group presents values for social costs from 2015 to 2050, assuming discount rates of 5%, 3%, 2.5% and the 95th percentile of the 3% discount rate. These values range from $11 to $212 (in 2007 dollars per metric ton of CO_2). These values could be used to monetize the costs imposed by the net greenhouse gas emissions associated with offshore oil and gas leasing. BOEM should incorporate those values into its PEIS and its net benefits analysis.	BOEM has adopted the approach of the Interagency Working Group on Social Cost of Carbon to estimate the social cost of carbon in a separate technical report. The results of that technical analysis are included in the Economic Analysis Methodology report that supports the Proposed Final Program. In addition, the PEIS incorporates by reference and summarizes the GHG emissions analysis from the technical report. The report is available at www.boem.gov.
329	Erik Grafe, Earthjustice	In addition to inadequately assessing background climate conditions over the course of the Program's multi-decade timeline, BOEM also fails completely to assess the Program's impacts in the context of this climate change. It does not attempt to describe how the effects of Program activities over time will interact with the effects of climate change over time on species and resources in the program areas. For example, as the Draft PEIS acknowledges, reductions in sea-ice are projected to have serious adverse effects on marine mammals, including polar bears, walruses, and ice seals in the Arctic Ocean. However, the Draft PEIS contains no analysis whatsoever of how the Program activities, when added to the increasing stresses these species will likely experience over time from climate change, would affect the species.	On August 1, 2016, CEQ issued Final Guidance for the Consideration of Greenhouse Gas Emissions and the Effects of Climate Change in National Environmental Policy Act Reviews. The Final PEIS addresses the effects of climate change consistent with that guidance, including describing the sensitivity of resources to future impacts because of changing climate. BOEM has also quantified downstream greenhouse gas emissions as a proxy for assessing climate change effects.

Comment ID	Commenter	Comment	Response
330	Erik Grafe, Earthjustice	To inform any decision whether to include the Arctic Ocean in the Five Year Program, BOEM must analyze the fundamental differences in oil spill prevention, response, and cleanup in the Arctic, as compared to the rest of the country, and the differential environmental impacts of an oil spill across regions. The Draft PEIS's treatment of oil spills amounts to little more than general statements like the following: "In the Arctic, oil spill response equipment is regionally staged; however, due to the remoteness, exploration and development drilling programs also necessitate the added precaution and mobilization of specific oil spill containment, response, and cleanup vessels and equipment in case of an incident," and "oil spills are considered non-routine, accidental occurrences" that could have varying impacts on people, species, and the environment generally. These and similar references do not provide a useful comparative analysis of differential regional oil spill impacts, including differences in oil spill response capability.	The PEIS identifies and discusses the differences and challenges of spill response in the Alaskan environment in the Accidental Spills and Catastrophic Discharge Events Section, Chapter 4, dealing with ice, cold, and limited daylight conditions. Individual resources potentially impacted by a catastrophic discharge event (CDE), including those in Alaska, are discussed in the Potential Impacts per Resource Area Section, Chapter 4. This analysis of potential impacts is broad and considers entire planning areas. At subsequent lease sale stages, more specific information will be available regarding the location and level of activity, spill risk of proposed activities, and specific environmental resources in the area. At subsequent stages, BOEM might also conduct Oil Spill Risk Analysis modeling to better estimate spill risk, spill trajectories, and probability of contact with an environmental resource. Spill response methods and specifics would be analyzed in more detail in the individual lease sale stage environmental review documents as well as in spill response plans submitted as part of lessees' Exploration Plans and Development and Production Plans.
331	Erik Grafe, Earthjustice	The Draft PEIS fails to address these problems of spill response efficacy in a realistic fashion. Unlike every other region of the country, Arctic conditions will make recovery of significant quantities of oil even less likely and the lack of infrastructure only exacerbates this problem. These differences are relevant to BOEM's decisions regarding which areas of the country should be included in the Five Year Program, and they must be examined in the Final PEIS. The Draft PEIS also fails to address the unique nature of the Arctic Ocean's oil spill response gap. A response gap analysis evaluates the amount of time oil spill responders are unable to work based on, among other things, adverse weather conditions, and delays in deployment of equipment and personnel. The Draft PEIS does not address the unique situation confronting any offshore drilling program in the Arctic Ocean.	The PEIS identifies and discusses the differences and challenges of spill response in the Alaskan environment in the Accidental Spills and Catastrophic Discharge Events Section, Chapter 4, dealing with ice, cold, and limited daylight conditions. Individual resources potentially impacted by a catastrophic discharge event (CDE), including those in Alaska, are discussed in the Potential Impacts per Resource Area Section, Chapter 4. This analysis of potential impacts is broad and considers entire planning areas. At subsequent lease sale stages, more specific information will be available regarding the location and level of activity, spill risk of proposed activities, and specific environmental resources in the area. At subsequent stages, BOEM might also conduct Oil Spill Risk Analysis modeling to better estimate spill risk, spill trajectories, and probability of contact with an environmental resource. Spill response methods and specifics would be analyzed in more detail in the individual lease sale stage environmental review documents as well as in spill response plans submitted as part of lessees' Exploration Plans and Development and Production Plans.

Comment ID	Commenter	Comment	Response
332	Erik Grafe, Earthjustice	The Final PEIS ultimately must account for the fact that differences in response efficiency and capabilities in the Arctic Ocean have direct and significant effects on the environment that are unlike those in other parts of the country. Iñupiat communities hunt and fish for a variety of species, including bowhead whales, walrus, seals, beluga whales, polar bears, birds, and fish, to provide food for their families and communities. An oil spill in the Chukchi or Beaufort Sea would have significant impacts on people, mammals, bird life, and wildlife habitats, including in some instances population-level effects on wildlife. The inefficiency inherent in spill response efforts in the icy waters of the Arctic Ocean exacerbates these problems and, therefore, BOEM must analyze these differential effects when deciding whether to include the Arctic Ocean in the Five Year Program.	The PEIS identifies and discusses the differences and challenges of spill response in the Alaskan environment in the Accidental Spills and Catastrophic Discharge Events Section, Chapter 4, dealing with ice, cold, and limited daylight conditions. Individual resources potentially impacted by a catastrophic discharge event (CDE), including those in Alaska, are discussed in the Potential Impacts per Resource Area Section, Chapter 4. This analysis of potential impacts is broad and considers entire planning areas. At subsequent lease sale stages, more specific information will be available regarding the location and level of activity, spill risk of proposed activities, and specific environmental resources in the area. At subsequent stages, BOEM might also conduct Oil Spill Risk Analysis modeling to better estimate spill risk, spill trajectories, and probability of contact with an environmental resource. Spill response methods and specifics would be analyzed in more detail in the individual lease sale stage environmental review documents as well as in spill response plans submitted as part of lessees' Exploration Plans and Development and Production Plans.
333	Erik Grafe, Earthjustice	Beyond oil spills, the Draft PEIS also offers no meaningful assessment of the other comparative impacts across the various regions proposed for inclusion in the Five Year Program. The Draft PEIS contains a chart providing labels that characterize impacts as “negligible”, “minor”, “moderate”, or “major.” Aside from this chart, in the vast majority of instances, the Draft PEIS does not compare effects among the different regions. And significantly, the agency does not explain the analysis providing the basis for the labels it assigns in its one comparative chart. As a result, it never describes the unique and different impacts oil and gas activities can have in different regions under consideration in the Program and its alternatives.	The Draft PEIS provides an analysis of impacts between the OCS Program Areas. As stated in the Chapter 4 Introduction, some impacts involve features specific to particular program areas, and these are identified as warranted. However, most conclusions on impacts involve considerations that are common throughout a program area, and some conclusions on impacts cross all program areas. For this reason, the discussion of impacts for Alternative A is not structured by program area. Definitions for impact levels are described in the Chapter 4 Introduction.

Comment ID	Commenter	Comment	Response
334	Erik Grafe, Earthjustice	For example, with regard to marine and coastal birds, the Draft PEIS never mentions the dramatic differences between the presence of important bird areas across the Arctic, as compared to other regions, or how the agency addressed those differences in characterizing the differential impacts between regions. Unlike the Gulf of Mexico and the Atlantic regions, the Arctic has numerous areas recognized as “Globally Important” and “Continental” important bird areas. The Draft PEIS acknowledges that “several areas within the Beaufort and Chukchi Seas have been recognized as Important Bird Areas (IBAs) of global significance by the National Audubon Society.” Yet the Draft PEIS does not assess unique affects to those areas, and inexplicably characterizes the impacts of the action alternatives across every region as “minor.” It also fails to address the unique consequences of oil spills reaching areas of global and continental significance for bird species.	Important Bird Areas in Alaska are addressed in Appendix C. The level of analysis presented is appropriate for a programmatic EIS. More thorough assessments of impacts on important bird areas will be included in Arctic region-, lease-, or activity-specific NEPA documents prepared by BOEM.
335	Erik Grafe, Earthjustice	Similarly, BOEM fails to address the differential effects on marine mammals across the regions. In the Arctic, for example, it fails to evaluate the additive effects oil and gas activities would have on species already suffering from the impacts of climate change. By way of illustration, ice-dependent species like walruses historically relied on the summer sea ice as a resting surface from which to access the seafloor during feeding dives, as well as for nursing and caring for their young. Sea ice also serves to protect walruses, and females and their young in particular, from terrestrial predators that would threaten them if they hauled out on land. Climate change, however, has greatly reduced the extent and thickness of summer sea ice over the past several decades and the loss of summer sea ice forces walruses to change their use of habitat in dramatic ways and expend more energy to reach critical feeding grounds. These changes increase walruses’ vulnerability to predation and disturbance, resulting in increased mortality rates among calves, reductions in available prey, declines in individual health, and overall population decline. Due in large part to these climate change related impacts, the U.S. Fish and Wildlife Service has determined that walruses warrant listing as endangered or threatened under the Endangered Species Act.	On August 1, 2016, CEQ issued Final Guidance for the Consideration of Greenhouse Gas Emissions and the Effects of Climate Change in National Environmental Policy Act Reviews. The Final PEIS addresses the effects of climate change consistent with that guidance, including describing the sensitivity of resources to future impacts because of changing climate. BOEM has also quantified downstream greenhouse gas emissions as a proxy for assessing climate change effects. The level of analysis in the PEIS is in compliance with recent CEQ guidance on programmatic reviews (CEQ 2014) and is an appropriate level of detail for the decision at hand. The analysis is at a national level, and the scope of impacts is described broadly. If a decision is made to move forward with any of the proposed lease sales in the Proposed Five Year Program, additional reviews will take place that will be more site-specific and will analyze impacts on ESA listed and non-listed species in greater detail. Subsequent incremental NEPA documents will be written at the individual lease sale level.

Comment ID	Commenter	Comment	Response
337	Erik Grafe, Earthjustice	BOEM'S failure to assess how oil and gas produced as a result of the Program will contribute to climate change violates NEPA. NEPA requires an assessment of the climate impacts of burning fossil fuels that could be extracted from the Proposed Program areas. The Draft PEIS contains no analysis whatsoever of how the Program activities, when added to the increasing stresses these species will likely experience over time from climate change, would affect the species. This is a critical omission in light of the fact that BOEM is here assessing an action with effects spanning 70 years, during which time BOEM assumes temperatures may rise over 5°C globally.	On August 1, 2016, CEQ issued Final Guidance for the Consideration of Greenhouse Gas Emissions and the Effects of Climate Change in National Environmental Policy Act Reviews. The Final PEIS addresses the effects of climate change consistent with that guidance, including describing the sensitivity of resources to future impacts because of changing climate. BOEM has also quantified downstream greenhouse gas emissions as a proxy for assessing climate change effects.
338	Erik Grafe, Earthjustice	The Draft PEIS's failure to assess the decision in the context of climate science and the commitment to limit global temperature rise violates the National Environmental Policy Act (NEPA); robs the decisionmaker and public of information that is critically relevant to the decision of whether, where, and when to open additional areas of our oceans to fossil-fuel extraction; and skews the analysis in favor of offshore leasing.	On August 1, 2016, CEQ issued Final Guidance for the Consideration of Greenhouse Gas Emissions and the Effects of Climate Change in National Environmental Policy Act Reviews. The Final PEIS addresses the effects of climate change consistent with that guidance, including describing the sensitivity of resources to future impacts because of changing climate. BOEM has also quantified downstream greenhouse gas emissions as a proxy for assessing climate change effects.
340	Erik Grafe, Earthjustice	BOEM's analysis of the other impact producing factors is unsubstantiated and incomplete. Beyond oil spills, the Draft PEIS also offers no meaningful assessment of the other comparative impacts across the various regions proposed for inclusion in the Five Year Program. Despite these concerns, the Draft PEIS fails to examine the differential impacts on walrus, or any other species, if the Arctic Ocean is included in the Five Year Program given the unique climate change-related pressures Arctic species are already experiencing. In most cases the Draft PEIS offers a handful of paragraphs addressing impacts, but it fails to address the differential impacts oil and gas activity would have on wildlife in the Arctic Ocean given climate change is already adversely affecting Arctic habitats and animal behavior in ways the rest of the country is not experiencing.	On August 1, 2016, CEQ issued Final Guidance for the Consideration of Greenhouse Gas Emissions and the Effects of Climate Change in National Environmental Policy Act Reviews. The Final PEIS addresses the effects of climate change consistent with that guidance, including describing the sensitivity of resources to future impacts because of changing climate. BOEM has also quantified downstream greenhouse gas emissions as a proxy for assessing climate change effects. The level of analysis in the PEIS is in compliance with recent CEQ guidance on programmatic reviews (CEQ 2014) and is an appropriate level of detail for the decision at hand. The analysis is at a national level, and the scope of impacts is described broadly. If a decision is made to move forward with any of the proposed lease sales in the Proposed Five Year Program, additional reviews will take place that will be more site-specific and will analyze impacts on ESA listed and non-listed species in greater detail. Subsequent incremental NEPA documents will be written at the individual lease sale level.

Comment ID	Commenter	Comment	Response
341	Erik Grafe, Earthjustice	BOEM's analysis of oil spills is inadequate. To inform any decision whether to include the Arctic Ocean in the Five Year Program, BOEM must analyze the fundamental differences in oil spill prevention, response, and cleanup in the Arctic, as compared to the rest of the country, and the differential environmental impacts of an oil spill across regions.	Challenges and limitations of oil spill response in the Arctic are discussed in the Accidental Spills and Catastrophic Discharge Events Section of the PEIS. This includes difficulties from remote access, lack of infrastructure, shallow water limitations, and icy conditions resulting in greater impacts from a potential accidental spill or catastrophic discharge event in the Arctic. Consideration was given to these concerns at a programmatic level and more detailed analyses of these concerns were cited (NRC 2014). In addition, evaluations included consideration of fate and transport of oil, region-specific physical and environmental factors, and potential impacts for each evaluated resource. Potential impacts from accidental spills and unexpected catastrophic discharge events (CDE) for each resource was given a rating ranging from negligible to major based on the evaluation. Through the scoping process, BOEM actively solicited the most recent and available science/data necessary to effectively describe all potential impact pathways relevant to the Proposed Action. The level of analysis in the PEIS is in compliance with recent CEQ guidance on programmatic reviews (CEQ 2014) and is an appropriate level of detail for the decision at hand. The analysis is at a national level, and the scope of impacts is described broadly. If a decision is made to move forward with any of the proposed lease sales in the Proposed Five Year Program, additional reviews will take place that will be more site-specific and will analyze impacts on ESA listed and non-listed species in greater detail. Subsequent incremental NEPA documents will be written at the individual lease sale level.
157	Evan Fuery	The industry is able to operate safely, and increasingly so, through new standards and regulations, plus the creation of the Center for Offshore Safety, and these improvements need to be recognized in consideration of licensing and plans for further development of the GOM.	A review of any new industry standards or regulatory commitments would be included within the subsequent lease sale stage environmental review documents.
486	Gail Adams-Jackson	We believe the number and scope of lease sales in Proposed Action does not adequately take into account the projected increase in energy demand. This is the time for our nation to take advantage of low oil prices to ensure affordable home-grown energy for generations to come. In order to secure our nation's energy future, oil and gas must be a critical part of the energy strategy as renewable energy is developed and comes online.	The underlying purpose of the Proposed Action is to help best meet anticipated energy demand in the future balancing environmental protection. The Program would result in sustained or increased OCS oil and gas production for the next 40-70 years. The Program schedules potential lease sales in the Beaufort Sea, Chukchi Sea, Cook Inlet, and Gulf of Mexico from 2017-2022. To help support the Secretary's decisionmaking, BOEM models energy supply, demand, and oil and gas production compared to baseline projections from the Energy Information Administration. Figure 1.2-1, Energy Use in the United States by Type, has been updated to include energy consumption projections based on EIA data.

Comment ID	Commenter	Comment	Response
74	Grace Nix	The plan does not explore the No Action Alternative, which must be explored if input from those affected is to be seriously considered.	The document has been revised to include resource-specific discussions of the potential impacts of the No Action Alternative. BOEM has reviewed the No Action Alternative assumptions and effects analyses and has ensured adequate consideration of the potential impacts.
262	Gwynn Crichton, The Nature Conservancy	The Conservancy submits that landscape-level mitigation policies can support efficient government decisionmaking, predictability for project proponent, and improved conservation outcomes. BOEM has included many of the high-level principles of this approach in its Proposed Program. However, we strongly encourage BOEM to commit to laying out clear, transparent guidance on how the bureau will apply these high-level principles on a landscape-scale throughout the entire leasing process. Such guidance should detail the specific methods, data, analysis, and framework involved at the different phases of permitting starting with the scoping process of the Five Year Program down to the permitting of specific production wells.	Following the approval of the 2017-2022 Program, BOEM will consider and, where appropriate, employ additional mitigation (including the full hierarchy of avoidance, minimization, and compensation) in the later stages of the oil and gas development process under OCSLA. Appropriately scaled analyses at these later decisions for leasing, exploration, development, and production can best identify specific mitigation measures, including required compensatory mitigation measures. BOEM follows departmental guidance and is in the process of developing further strategies to employ landscape scale analyses and compensatory mitigation as a part of the mitigation hierarchy. More detailed information will be forthcoming in later stages of the NEPA process.
456	Isaac Nukapigak, Kuukpik Corporation	The Kuukpik Corporation ("Kuukpik") writes to join other North Slope stakeholders in requesting a 60 day extension of the public comment period on the Draft Programmatic Environmental Impact Statement for the 2017-2022 Outer Continental Shelf ("OCS") Oil and Gas Leasing Program ("Program").	On March 18, 2016, BOEM published a Notice of Availability of the Draft PEIS for the 2017-2022 Oil and Gas Leasing Program. NEPA requires a minimum 45-day comment period on Draft PEIS documents, a period which may be extended at the discretion of the agency issuing the document. In the case of the Five Year Draft PEIS, BOEM determined that 45 days was adequate and appropriate for a Programmatic document. However, all stakeholders were encouraged to provide comments on the 2017-2022 Proposed Program during the comment period, which ended June 16, 2016. BOEM recognizes the importance of input from public stakeholders, and appreciates the timing constraints noted by the commenter.
163	Isaac Ojeda	The Draft PEIS does not adequately describe or provide compelling support for the assumptions or effects analyses related to the No Action Alternative. As a result, the effects analyses appears to overstate the adverse consequences of the No Action and understate the beneficial consequences of the No Action.	The document has been revised to include resource-specific discussions of the potential impacts from implementing the No Action Alternative. BOEM has reviewed the No Action Alternative assumptions and effects analyses and has ensured adequate consideration of the potential impacts.

Comment ID	Commenter	Comment	Response
164	Isaac Ojeda	The range and scope of alternatives should consider the implications of the recent Paris Agreement signed this year by the U.S. Government. The commitments made in the Paris Agreement should be evaluated and compared under Proposed Action and No Action Alternatives.	On August 1, 2016, the Council on Environmental Quality issued Final Guidance for the Consideration of Greenhouse Gas Emissions and the Effects of Climate Change in National Environmental Policy Act Reviews. The Final PEIS quantifies downstream greenhouse gas emissions as a proxy for assessing climate change effects consistent with that guidance. BOEM's economic analysis has also been revised to reflect the EIA's 2016 Annual Energy Outlook Reference Case, which accounts for the Clean Power Plan. BOEM addresses the Intended Nationally Determined Contributions (INDCs) that the U.S. delegation submitted to the United Nation under the Paris Agreement's framework. In addition, the new emissions estimates, which include downstream emissions are compared to both goals submitted to the UN for 2020 and 2025, as well as the longer-term goal by the Obama Administration to reach an 83% reduction by 2050. BOEM has not modeled actual demand or supply changes, or infinite other potential pathway, that could lead to various carbon targets. BOEM has not separately modeled future demand or corresponding consumption levels that would correspond to specific emission-reductions targets as that is outside the scope of this PEIS. However, it is important to note that the U.S. INDC scenario does not assume “zero” oil and gas production or consumption in the future, but declining rather emissions from oil. The U.S. has made notable progress towards its 2025 emissions reduction target through measures identified in the President’s Climate Action Plan and will continue to do so. BOEM must continue to work within the organizing principal of OCSLA which directs, subject to environmental safeguards, the expeditious development of OCS resources.
165	Isaac Ojeda	The PEIS should consider the implications of other domestic oil and gas production (i.e., non-OCS) in the United States on the Proposed Action, as there is a current overstock of domestic oil and gas that is leading to exporting. For example, there is no mention in the PEIS of the LNG export terminals being built to export much of U.S. natural gas to the world market.	Chapter 6 of the 2017-2022 Outer Continental Shelf Oil and Gas Leasing Proposed Program (BOEM, March 2016) address the supply of non-OCS oil and gas. The LNG export terminals are not reasonably foreseeable connected actions of the program. LNG facilities are addressed in No Action Alternative and as a cumulative action in the cumulative effects analysis.
70	James Hartwell	The Draft Programmatic Environmental Impact Statement has not fully evaluated all impacts of the proposed plan, especially those indirect and cumulative effects associated with climate change.	On August 1, 2016, the Council on Environmental Quality issued Final Guidance for the Consideration of Greenhouse Gas Emissions and the Effects of Climate Change in National Environmental Policy Act Reviews. The Final PEIS quantifies downstream greenhouse gas emissions as a proxy for assessing climate change effects consistent with that guidance. BOEM has prepared a new technical report (available at www.boem.gov) that quantifies the potential downstream greenhouse gas emissions associated with ongoing OCS Program and potential 2017-2022 Program oil and gas activities. Climate change is also discussed within resource sections, as appropriate.

Comment ID	Commenter	Comment	Response
71	James Hartwell	The No Action Alternative has also not been adequately assessed.	The document has been revised to include resource specific discussions of the potential impacts of the No Action Alternative. BOEM has reviewed the No Action Alternative assumptions and effects analyses and has ensured adequate consideration of the potential impacts.
548	Jeff Chen	There are significant impacts not addressed in the PEIS that can contribute to catastrophic climate change. Development of the OCS will lead to more fossil fuel mega-projects that are directly responsible for global climate change, ocean acidification, and destruction of indigenous ways of life. It's been documented that marine mammals and fish have been migrating to different places throughout the Arctic due to warming temperatures. Some of that migration is happening northward, which is shifting where fish spend much of their time. Some wildlife have been unable to adapt and are dying off. With these shifts in wildlife habitat, it's irresponsible to continue development of the Arctic. Development of the OCS will burn more fossil fuels, leading to more carbon in the atmosphere and in our oceans. Ocean acidification is already wreaking havoc on marine species and will only get worse.	On August 1, 2016, the Council on Environmental Quality issued Final Guidance for the Consideration of Greenhouse Gas Emissions and the Effects of Climate Change in National Environmental Policy Act Reviews. The Final PEIS addresses the effects of climate change consistent with that guidance, including describing the sensitivity of resources to future impacts because of a changing climate. BOEM has prepared a new technical report (available at www.boem.gov) that quantifies the potential downstream greenhouse gas emissions and the social cost of carbon associated with ongoing OCS Program and 2017-2022 Program oil and gas activities and consumption of oil and gas produced on the OCS.
549	Jeff Chen	OCS development in the Gulf of Mexico will also affect sociocultural systems negatively, which is not reflected in the Draft PEIS.	Information regarding the affected environment for Population, Employment, and Income is presented in Section 4.3, with additional information presented in Appendix C. Potential impacts from the Proposed Action on Population, Employment, and Income are presented in Chapter 4. The level of analysis presented in these chapters is appropriate for a programmatic EIS. Potential impacts on socioeconomic issues are also discussed in the Gulf of Mexico Multisale EIS. For more information on the risks and benefits of the Gulf of Mexico lease sales in the Proposed Program, see the Gulf of Mexico OCS Region Benefits and Risks Section of BOEM's 2017-2022 Outer Continental Shelf Oil and Gas Leasing Proposed Program Decision Document. The "equitable sharing" analysis includes environmental risks of the program proposal, as well as those of the energy substitutes that would most likely take the place of OCS production in the absence of the proposed lease sales (No Action Alternative). The section also provides discussions of increased wages, additional jobs, increased tax collections, and revenue sharing likely to result from the GOM sales.

Comment ID	Commenter	Comment	Response
200	Jeffrey Harris, Louisiana Department of Natural Resources	The State of Louisiana maintains that Louisiana's sensitive coastline continues to suffer consequences from OCS activities, which may not be attributed to a single action or operator, but are certainly a result of OCS leasing and associated activities. Over time these incremental and aggregate injuries become significant impacts, and it is the responsibility of BOEM to manage "environmentally and economically responsible development of the nation's offshore energy and mineral resources." With that in mind, the State of Louisiana encourages the use of compensatory mitigation to offset unavoidable impacts. BOEM has recently published environmental documents with inconsistent policy statements about the use of compensatory mitigation. The Draft PEIS states that compensatory mitigation will be considered at subsequent decision levels where appropriate, whereas the GOM Draft Multisale EIS states that compensatory mitigation will be handled at the Five Year stage. These two statements appear to contradict one another. The Office of Coastal Management (OCM) strongly urges BOEM to identify and quantify the accumulating coastal impacts of OCS lease sales to Louisiana, and make provisions for appropriate compensatory mitigation for unavoidable adverse impacts.	BOEM recognizes the apparent, but unintended, contradiction in statements on compensatory mitigation in the GOM Draft Multisale EIS and the Draft PEIS for the Five Year Program. BOEM is in the process of developing a compensatory mitigation program to determine how and at what stage(s) it could be applied to BOEM-regulated activities. The information provided in the PEIS is intended to provide a high-level overview of how BOEM could use a landscape-level approach to planning and mitigating impacts, including implementation of the full mitigation hierarchy.
158	Jennie Gosche	The U.S. population of polar bears den on the coast of the Arctic National Wildlife Refuge and any oil drilling, roads, or other infrastructure would disturb female polar bears and their cubs in the dens. A mother polar bear may abandon her den and cubs if disturbed and as a consequence the cubs would die. The U.S. population of polar bears has declined precipitously in the last 8 years and is now estimated to be only 900 individual bears. Therefore, every cub is important to maintain, and hopefully increase, the U.S. polar bear population.	Analysis of potential impacts to marine mammals, including polar bears, is included in Chapter 4. In addition, Alternative B considers environmentally important areas (EIAs) in the Arctic that, if selected for exclusion from the Program, could help avoid or minimize impacts to polar bears and other marine mammals. Should an Arctic lease sale move forward under the 2017-2022 Program, additional analyses would be conducted that would disclose potential impacts to polar bears in the level of detail appropriate to that stage of review.
187	Jessica Girard, Northern Alaska Environmental Center	And so I would encourage BOEM to investigate and to require the study of the climate change impacts, not just of the CO_2 emitted from the drilling activities, themselves, but also from burning the resources that they hope to open up to extraction.	On August 1, 2016, CEQ issued Final Guidance for the Consideration of Greenhouse Gas Emissions and the Effects of Climate Change in National Environmental Policy Act Reviews. The Final PEIS addresses the effects of climate change consistent with that guidance, including describing the sensitivity of resources to future impacts because of changing climate. BOEM has also quantified downstream greenhouse gas emissions as a proxy for assessing climate change effects.

Comment ID	Commenter	Comment	Response
188	Jessica Girard, Northern Alaska Environmental Center	I just read about a major scientific study. It was published in the Nature Climate Change. And it showed that even if carbon reduction targets are achieved, and the planet's temperature is kept below the two degree Celsius warming threshold, sea level rise, we'll still inundate major coastal cities, forcing one-fifth of the total world population of humans to migrate.	The McGlade and Ekins study has been incorporated into the analysis.
189	Jessica Girard, Northern Alaska Environmental Center	One other aspect related to the current Draft PEIS, which I have not finished reading, is that they had provided some numbers as to likely spill events over a 40-year period, which basically comes down to about 7,800 barrels in a given year. That premise is also apparent based on the number of pipelines that would need to be laid. For example, BOEM identifies potentially five or six platforms and 120 miles of offshore pipeline. Well, if you have six platforms, that's only 20 miles per platform. But we also have a 25-mile buffer zone, so I think the numbers are significantly understated, and that would, therefore, result in a much greater number of normal incidental oil spills on an annual basis.	In the Chukchi Sea, the Proposed Program exploration and development scenario was founded on the assumption that the discovery and subsequent development of at least one field from existing leases issued in previous Programs would serve to "anchor" future discoveries stemming from the 2017-2022 OCS Leasing Program. However, due to recent relinquishments of Chukchi Sea leases, infrastructure assumptions have been updated. For example, construction of new pipeline is now being considered as part of the Proposed Action.

Comment ID	Commenter	Comment	Response
201	Jessica Wentz, Sabin Center for Climate Change Law, Columbia Law School	We are concerned about BOEM's failure to fully disclose GHG emissions that may result from the Proposed Action, specifically the failure to estimate downstream GHG emissions associated with transportation and combustion of oil and gas resources that may be produced under the Proposed Program. The Draft PEIS includes GHG emissions from exploration, development, and production of oil and gas on the OCS, including emissions from the use of combustion engines in vessels, construction, drilling, and other equipment as well as through deliberate or accidental release of CH_4. But, there is no break-down of emissions from specific sources or activities. Moreover, the Draft PEIS or supporting economic methodologies paper does not fully explain how BOEM calculated CO_2 emissions from activities occurring on the OCS. As for cumulative emissions in the leasing area, the Draft PEIS merely notes that such emissions include current operations, the Proposed Action, and expected future development beyond the Proposed Action. We recommend that BOEM revise the PEIS to address these deficiencies and quantify all downstream emissions, including emissions from the transportation, processing and end-use of OCS oil and gas, or at least, clarify why such emissions were omitted from analyses. For downstream transportation emissions, BOEM can use the same methodology it employed in the economic analysis document. For combustion emissions, BOEM can refer to emissions factors developed by the Environmental Protection Agency (“EPA”) and the Energy Information Administration (“EIA”). A variety of other data sets and modeling tools are available to calculate emissions from processing OCS oil and gas.	On August 1, 2016, CEQ issued Final Guidance for the Consideration of Greenhouse Gas Emissions and the Effects of Climate Change in National Environmental Policy Act Reviews. The Final PEIS addresses the effects of climate change consistent with that guidance, including describing the sensitivity of resources to future impacts because of changing climate. BOEM has also quantified downstream greenhouse gas emissions as a proxy for assessing climate change effects. A new technical report prepared by BOEM (available at www.boem.gov) explains the calculation of greenhouse emissions, including the use of the Offshore Environmental Cost Model to estimate emissions that occur on the OCS from OCS activities. BOEM's quantification of emissions uses data from EPA and EIA for emissions factors and end-use consumption trends, respectively. The PEIS provides estimates of greenhouse gas emissions at an aggregated level to highlight the differences in alternatives.

Comment ID	Commenter	Comment	Response
202	Jessica Wentz, Sabin Center for Climate Change Law, Columbia Law School	Analysis of downstream GHG emissions is appropriate and useful to include in the PEIS, including for the Proposed Action and No Action Alternatives which differ. BOEM should reevaluate its projections of fossil fuel demand and consumption under the No Action and specifically consider a future baseline in which the U.S. does meet the emissions targets set forth in our Intended Nationally Determined Contribution (INDC). BOEM cannot circumvent quantifying end-use emissions by stating that such emissions will be "roughly equivalent" under the Proposed Action and the No Action Alternative because other fossil fuels would be substituted for OCS oil and gas, as this "perfect substitution" argument has been rejected by several federal courts. BOEM concludes that total GHG emissions will be substantially higher under the No Action Alternative because most of the unproduced OCS oil and gas would be replaced with fossil fuels from other domestic sources and international imports. BOEM relies on the Energy Information Agency (EIA)'s 2015 Reference Case to calculate future demand for oil and gas in the United States. The problem with using the Reference Case is that EIA reflects a business-as-usual forecast that does not account for present and future actions aimed at reducing fossil fuel consumption in the United States. Specifically, the Reference Case does not account for the implementation of current regulations and policies, such as the Clean Power Plan and the federal moratorium on new coal leases. The Reference Case also reflects a scenario in which the U.S. would completely fail to meet our domestic and international climate goals.	On August 1, 2016, the Council on Environmental Quality issued Final Guidance for the Consideration of Greenhouse Gas Emissions and the Effects of Climate Change in National Environmental Policy Act Reviews. The Final PEIS quantifies downstream greenhouse gas emissions as a proxy for assessing climate change effects consistent with that guidance. BOEM's economic analysis has also been revised to reflect the EIA's 2016 Annual Energy Outlook Reference Case, which accounts for the Clean Power Plan. BOEM addresses the Intended Nationally Determined Contributions (INDCs) that the U.S. delegation submitted to the United Nation under the Paris Agreement's framework. In addition, the new emissions estimates, which include downstream emissions are compared to both goals submitted to the UN for 2020 and 2025, as well as the longer-term goal by the Obama Administration to reach an 83% reduction by 2050. BOEM has not modeled actual demand or supply changes, or infinite other potential pathway, that could lead to various carbon targets. BOEM has not separately modeled future demand or corresponding consumption levels that would correspond to specific emission-reductions targets as that is outside the scope of this PEIS. However, it is important to note that the U.S. INDC scenario does not assume "zero" oil and gas production or consumption in the future, but declining rather emissions from oil. The U.S. has made notable progress towards its 2025 emissions reduction target through measures identified in the President's Climate Action Plan and will continue to do so. BOEM must continue to work within the organizing principal of OCSLA which directs, subject to environmental safeguards, the expeditious development of OCS resources.

Comment ID	Commenter	Comment	Response
530	Jessica Wentz, Sabin Center for Climate Change Law, Columbia Law School	BOEM has conducted a cost-benefit analysis consistent with Section 18 of OCSLA, which is incorporated by reference into the PEIS. Without explanation, BOEM omitted GHG emissions from its cost estimates. This is a problematic omission, since the climate impacts of the 2017-2022 OCS Program are likely significant, especially if accounting for downstream emissions from oil and gas end-use. We urge BOEM to use the Social Cost of Carbon (SCC) and other methods to assign a cost value to both direct and indirect GHG emissions that will occur under the Proposed Program, including the downstream emissions.	On August 1, 2016, the Council on Environmental Quality issued Final Guidance for the Consideration of Greenhouse Gas Emissions and the Effects of Climate Change in National Environmental Policy Act Reviews. The Final PEIS addresses the effects of climate change consistent with that guidance, including describing the sensitivity of resources to future impacts because of a changing climate. BOEM has prepared a new technical report that quantifies the potential downstream greenhouse gas emissions and the social cost of carbon associated with ongoing OCS Program and 2017-2022 Program oil and gas activities and consumption of oil and gas produced on the OCS. The technical report is referenced and summarized in the PEIS and other relevant Program documents. The net benefits analysis does not include or quantify all potential domestic or global benefits or costs as explained in the supplemental Economic Analysis Methodology report. The social cost of carbon is not incorporated into the net benefits analysis for the reasons described in the Economic Analysis Methodology report and Proposed Final Program. The PEIS discloses the relationship between that net benefits analysis and separate social cost of carbon analysis. Both reports are available at www.boem.gov.

Comment ID	Commenter	Comment	Response
531	Jessica Wentz, Sabin Center for Climate Change Law, Columbia Law School	The regulations implementing NEPA require federal agencies to consider whether a Proposed Action is consistent with the objectives of federal, regional, state and local land use plans, policies and controls. BOEM should discuss whether the Proposed Action and downstream GHG emissions are consistent with federal, state and local GHG emission targets and climate change policies. Based on this requirement, CEQ's revised Draft guidance on NEPA and climate change instructs agencies to provide a frame of reference for decisionmakers by disclosing the extent of a project's GHG emissions. BOEM should consider whether the Program is consistent with the key objective of the Paris Agreement—to limit global warming to "well below" a 2 degrees C increase above pre-industrial temperatures and seek to limit it to 1.5 degrees C. BOEM should evaluate whether the quantity of oil and gas that may be produced under the Proposed Program would exceed the share of oil and gas from U.S. reserves that can be extracted and consumed under both the 2 degrees C and 1.5 degrees C scenarios. To achieve Clean Power Plan coal-related reductions, it will be necessary to replace some amount of existing coal-fired electric capacity with natural gas and renewable energy. BOEM should consider whether the Program would contribute to the attainment of these targets and, moreover, how the implementation of the Clean Power Plan may affect predictions about fossil fuel use and substitution under the Proposed and No Action Alternatives.	The Council on Environmental Quality (CEQ) regulations implementing NEPA require that the PEIS discuss if there are conflicts between the Proposed Action and the objectives of current federal, regional, state and local land use plans, policies and controls for the area concerned. The PEIS should discuss any inconsistency of a Proposed Action with any approved state or local plan and laws as well. The provisions are being broadly interpreted in the comment to apply to climate change commitments. The Final PEIS quantifies downstream greenhouse gas emissions as a proxy for assessing climate change effects consistent with the CEQ's Final Guidance for the Consideration of Greenhouse Gas Emissions and the Effects of Climate Change in National Environmental Policy Act Reviews. Both the U.S. Department of Energy, Energy Information Agency and International Energy Agency anticipate a long-term need for oil and natural gas, with oil demand declining and natural gas demand increasing. BOEM recognizes that the future may also bring new legal and policy, technological, energy efficiency, or other market changes that could ultimately affect supply and demand. Both the EIA (Annual Energy Outlook 2016) and IEA (World Energy Outlook 2015) indicate that strong climate policies do not obviate the need for continued investment in oil and natural gas. Even if the U.S. moves decisively towards the demand and emissions trajectory implied by the IEA's 450 Scenario, large-scale investment in oil and gas remains an essential component of a low-cost transition to a low-carbon future. The U.S. INDCs and World Energy Outlook climate scenarios do not make that same conservative assumption that only proven offshore resources could be produced and still meet climate pledges. Recognizing this possibility, BOEM works within the organizing principal of OCSLA which directs, subject to environmental safeguards, the expeditious development of OCS oil and gas resources. BOEM anticipates that measures described under the President Obama's Climate Action Plan (fuel switching, energy efficiency improvements, and CAFE standards) can achieve the INDC pledges that were part of the Paris Agreement. Finally, BOEM has considered the potential implications of the Clean Power Plan revising its market substitution and net benefits analyses based on the EIA Annual Energy Outlook 2016.

Comment ID	Commenter	Comment	Response
242	Joanna Malaczynski, Surfrider Foundation	The PEIS must analyze in its range of alternatives renewable energy alternatives. Large-scale development of renewable energy infrastructure and power generation should be a reasonable alternative to drilling in Program Areas considered in the 2017-2022 planning process. The PEIS needs to comprehensively consider and disclose the significant role that renewable energy, energy efficiency, and energy conservation can play in meeting our nation's energy needs.	OCSLA specifically mandates the development of an OCS oil and gas program every five years; the PEIS is being developed to disclose the potential environmental impacts associated with the activities that may occur if leasing takes place. The document does not support nor presume an outcome but rather considers alternatives that meet the Purpose and Need as described in Chapter 1.
243	Joanna Malaczynski, Surfrider Foundation	The Proposed Action (Alternative A) in the Draft PEIS reflects the Draft Proposed Program, and therefore, the Proposed Action assumes offshore drilling in the Mid- and South Atlantic OCS Planning Areas. BOEM has extensively documented the number of oil wells that could be drilled in the Atlantic Program Area over the next fifty years. However, the Proposed Program ultimately excludes offshore drilling in the Atlantic based on overwhelming opposition to the proposal. The Draft PEIS is at odds with the Proposed Program and should reflect decision articulated in the Proposed Program. Accordingly, the Proposed Action should be the equivalent of Alternative (B)(5)(a) in the Draft PEIS, excluding the Atlantic Program Area and any and all seismic testing in the Atlantic.	The Atlantic Program Area has been removed from consideration for the 2017-2022 leasing period.
244	Joanna Malaczynski, Surfrider Foundation	Expansion of offshore drilling in the Alaska OCS would cause significant and adverse environmental impacts to our nation's richest coastal and marine ecosystems. Marine and coastal ecologies would suffer from loss of wildlife at a significant scale as a result of construction, pollution, and inevitable oil spills. The region would suffer from loss of clean water, ecological stability, scenic view sheds, and environmental resources. Such loss of environmental assets would be devastating to coastal industries in the Alaska region, including tourism, recreation, real estate, and fishing, among others. The Draft PEIS does not fully account for these significant environmental impacts.	The PEIS describes the important dimensions of the environment and analyzes potential impacts from an appropriate range of IPFs. The PEIS describes and analyzes potential impacts on all dimensions of the environment from air quality to environmental justice. The level of detail in the PEIS is appropriate for a programmatic EIS, consistent with CEQ's guidance. BOEM will conduct more detailed descriptions and analyses at the lease sale, exploration and development stages in NEPA documents.

Comment ID	Commenter	Comment	Response
245	Joanna Malaczynski, Surfrider Foundation	The PEIS should take a closer look at the environmental impacts of offshore drilling and seismic testing in the Atlantic and Arctic. The Final PEIS should acknowledge that offshore drilling and seismic testing have significant environmental, economic, and cumulative impacts that threaten our health and security, and that these impacts cannot be mitigated. Oil and gas development in new areas would adversely impact our health and safety because it would require seismic surveys, drilling operations, oil transport tankers, and the installation of platforms, pipelines, and other infrastructure in the program area. It would involve anticipated oil spills (including a potential catastrophic oil spill), regular toxic discharges, significant underwater noise pollution (devastating for critical species) and harmful emissions into our air, water, and soil. Collectively, and individually, these activities would significantly damage the environment, communities, and economies in the short-, medium- and long-term. Marine and coastal ecologies would suffer from loss of wildlife at a significant scale as a result of construction, pollution, and inevitable oil spills. Communities would suffer from loss of clean water, scenic view sheds, and environmental resources. Such loss of environmental assets would be devastating to coastal industries, including tourism, recreation, real estate, and fishing, among others. The Draft PEIS does not fully account for these significant environmental impacts.	The level of analysis in the PEIS is in compliance with recent CEQ guidance on programmatic reviews (CEQ 2014) and is an appropriate level of detail for the decision at hand. The analysis is at a national level, and the scope of impacts is described broadly. If a decision is made to move forward with any of the proposed lease sales in the Proposed Five Year Program, additional reviews will take place that will be more site-specific and will analyze impacts on listed and non-listed species in greater detail. Subsequent incremental NEPA documents will be written at the individual lease sale level.

Comment ID	Commenter	Comment	Response
524	Joanna Malaczynski, Surfrider Foundation	BOEM prematurely makes decisions in the Draft PEIS and Proposed Program not on the disclosure of environmental impacts, but on purported economic impacts and an outdated pricing model that assumes oil and gas extraction is the only way of meeting our nation's energy demand and needs. BOEM assumes in the Draft PEIS that if the Bureau does not facilitate oil and gas drilling in new Program Areas, the nation will need to meet its energy needs by domestic onshore drilling or importing energy. BOEM's analysis appears to be entirely dictated by this logic, as opposed to avoiding significant impacts to our environment.	BOEM recognizes that the future may bring new legal, policy, technological, or other market changes that could ultimately affect U.S. demand for and supply of oil and gas. Further cuts in energy sector emissions are necessary to meet any of the emission reduction targets specified in the 2015 Paris Agreement and President Obama's 2050 climate goals. However, Section 18 of OCSLA does not call for the development of a national energy strategy that prescribes targets for various energy sources. Rather, OCSLA calls for the Secretary to decide what areas of the OCS should be offered for oil and gas leasing and when. Therefore, the PEIS need only analyze alternatives of size, timing and location for such leasing. To help support the Secretary's decisionmaking, BOEM estimates the energy supply, demand, and oil and gas production compared to forecasts from the U.S. Energy Information Administration. Those forecasts do not speculate on the implications of new laws, regulations or policies that may affect the demand for and consumption of fossil fuels in the future. Energy substitutes for OCS oil and gas are estimated assuming a limited change in demand as indicated by EIA's forecast. The energy substitution analysis is integrated into the No Action Alternative. The comment does not suggest a substitute assumption set and economic model that would be more appropriate to consider for the purposes of this analysis. The No Action Alternative considers other energy sources as a means to avoid or minimize direct or indirect impacts on the OCS; however, those substitute energy sources, even renewable, could have different national or global environmental impacts.
525	Joanna Malaczynski, Surfrider Foundation	The exclusion of the Atlantic from the Proposed Program obviates any purported justification for seismic testing in the region, since seismic testing is a tool to discover oil and gas reserves. The PEIS should be revised to remove any discussion of seismic activities that may take place since leasing is no longer possible.	The decision to approve permits to conduct seismic testing is distinct from the decision to lease or not to lease in the Atlantic. The PEIS considers seismic testing as a connected action in its analysis. However, BOEM carefully considers permit applications for seismic surveys in the Atlantic.
67	Johanna de Graffenreid, Gulf Restoration Network	Currently the Environmental Impact Statement only includes four pages related to the impacts of these leases on climate change. Cumulative impacts on the climate from all of these lease parcels, along with the corresponding infrastructure is required by NEPA as well as the President's executive orders on climate change. Before this sale is to move forward, a comprehensive analysis of the exploration, drilling, pipelines, refineries, and associated production of oil and gas from these parcels must be included to meet the standards required under the National Environmental Policy Act.	BOEM has expanded the analysis to include downstream consumption of oil and gas. This includes emissions from exploration, drilling, pipelines, refineries, other onshore production, distribution and consumption of oil and gas products. The Final PEIS also includes analysis of how climate change could exacerbate the impacts from the Proposed Action where relevant.

Comment ID	Commenter	Comment	Response
68	Johanna de Graffenreid, Gulf Restoration Network	Other air impacts from exploration, drilling, pipelines, refineries, and associated production of the oil and gas directly connected and related to these lease sales must be included.	Air quality impacts are included in this PEIS for impacts from exploration, development, production, and offshore pipeline activities. Air quality impacts from activities occurring after the production stream leaves the production facilities, such as onshore pipelines after the distribution point and refineries, are beyond the scope of this PEIS, but are analyzed by the Federal and state agencies responsible for regulating those downstream actions.
554	Johanna de Graffenreid, Gulf Restoration Network	Currently, the cumulative analysis of health and air quality impacts are sorely lacking in this Environmental Impact Statement. Prior to any lease sale progressing on these parcels, cumulative impacts from the directly associated exploration and processing of oil must be addressed in the Environmental Impact Statement.	Additional information concerning cumulative effects and air quality have been provided in the Final PEIS. Human Health Effects are now addressed as an Issue of Programmatic Concern in the Final PEIS.
64	John Chauffe	We frequently go out to Horn Island and Deer Island to fish and just enjoy ourselves. I wonder how dozens more oil rigs are going to affect my family, and the families of fisherman who rely on the health of the fish for their livelihood.	Horn Island and Deer Island are both located within state waters. Oil platforms referred to in this PEIS are only located within Federal waters, not State waters. Oil platforms have been shown to increase availability of fish and are actually targeted by fishermen. Analysis of impacts on commercial and recreational fisheries is included in Chapter 4, Impacts Assessment as well as in Appendix E. Additionally, impacts on subsistence fishing is discussed in the Sociocultural Systems Sections of the Final PEIS.
65	John Chauffe	After going over the Draft Programmatic EIS it's clear that Alternative C: The No Action Alternative hasn't been fully assessed yet.	BOEM has reviewed the No Action Alternative assumptions and effects analyses and has ensured adequate consideration of the potential impacts. The document has been revised to include resource-specific discussions of the potential impacts of the No Action Alternative.
79	John Harrington	I do not think sufficient time has been allowed to review and comment on such a broad and complex document to allow the public to advise BOEM on what edits and changes need to be made to assure compliance with NEPA in order to reduce the risk that it could be subject to legal challenge.	On March 18, 2016, BOEM published a Notice of Availability of the Draft PEIS for the 2017-2022 Oil and Gas Leasing Program. NEPA requires a minimum 45-day comment period on Draft PEIS documents, a period which may be extended at the discretion of the agency issuing the document. In the case of the Five Year Draft PEIS, BOEM determined that 45 days was adequate and appropriate for a Programmatic document. However, all stakeholders were encouraged to provide comments on the 2017-2022 Proposed Program during the comment period, which ended June 16, 2016. BOEM recognizes the importance of input from public stakeholders, and appreciates the timing constraints noted by the commenter.

Comment ID	Commenter	Comment	Response
110	Julia Bevins	I was impressed with the care and oversight in putting together a plan for oil spill response. That being said, one uncomfortable, undeniable fact remains and that is it will be extremely difficult to clean up after a major oil spill in the Arctic Ocean, no matter what precautions are taken. There are so many variables with regards to ice and weather and it is a difficult place to operate.	The PEIS identifies and discusses the differences and challenges of spill response in the Alaskan environment in the Accidental Spills and Catastrophic Discharge Events Section, Chapter 4, dealing with ice, cold, and limited daylight conditions. Individual resources potentially impacted by a catastrophic discharge event (CDE), including those in Alaska, are discussed in the Potential Impacts per Resource Area Section, Chapter 4. This analysis of potential impacts is broad and considers entire planning areas. At subsequent lease sale stages, more specific information will be available regarding the location and level of activity, spill risk of proposed activities, and specific environmental resources in the area. At subsequent stages, BOEM might also conduct Oil Spill Risk Analysis modeling to better estimate spill risk, spill trajectories, and probability of contact with an environmental resource. Spill response methods and specifics would be analyzed in more detail in the individual lease sale stage environmental review documents as well as in spill response plans submitted as part of lessees' Exploration Plans and Development and Production Plans.
111	Julia Bevins	There are certain species, once oiled, which will probably die because they lose their insulation and cold kills. This includes polar bears, which are listed as a vulnerable species.	Impacts of oils spills are discussed generally for each resource for CDEs and smaller accidental spills in the Accidental Spills and Catastrophic Discharge Events Section, Chapter 4. The level of analysis presented in these sections is appropriate for a programmatic EIS. More detailed site specific assessments of direct and cumulative impacts from spills will be included in regional-, lease-, or activity-specific NEPA documents prepared by BOEM. These more detailed reviews include an examination of potential species impacts.
112	Julia Bevins	The environment takes much more time to recover from damage in cold temperatures. All the chemical reactions that govern life and growth are way slower and recovery takes much, much longer.	The PEIS identifies and discusses the differences and challenges of spill response in the Alaskan environment in the Accidental Spills and Catastrophic Discharge Events Section, Chapter 4, dealing with ice, cold, and limited daylight conditions. Impacts of oils spills are discussed generally for the regions included PEIS in the Accidental Spills and Catastrophic Discharge Events Section (Chapter 4) and more specifically for each resource for CDEs and smaller accidental spills in Potential Impacts per Resource Area Section (Chapter 4). These impact reviews include responses in cold weather environments.

Comment ID	Commenter	Comment	Response
440	Kellie O'Brien	The infrastructure in Northern AK is not technologically established to be able to respond to any oil spill in the Arctic Ocean. It took 3 months to cap the Deepwater Horizon in the Gulf of Mexico - an area heavily advanced in oil spill containment… Alaska is not prepared.	The PEIS identifies and discusses the differences and challenges of spill response in the Alaskan environment in the Accidental Spills and Catastrophic Discharge Events Section, Chapter 4, dealing with ice, cold, and limited daylight conditions. Individual resources potentially impacted by a catastrophic discharge event (CDE), including those in Alaska, are discussed in the Potential Impacts per Resource Area Section, Chapter 4. This analysis of potential impacts is broad and considers entire planning areas. At subsequent lease sale stages, more specific information will be available regarding the location and level of activity, spill risk of proposed activities, and specific environmental resources in the area. At subsequent stages, BOEM might also conduct Oil Spill Risk Analysis modeling to better estimate spill risk, spill trajectories, and probability of contact with an environmental resource. Spill response methods and specifics would be analyzed in more detail in the individual lease sale stage environmental review documents as well as in spill response plans submitted as part of lessees' Exploration Plans and Development and Production Plans.
441	Kellie O'Brien	If a spill happens and ice is present, the oil cannot be separated. If ice floes prohibit timely capping a spill could seep for months possibly.	The PEIS identifies and discusses the differences and challenges of spill response in the Alaskan environment in the Accidental Spills and Catastrophic Discharge Events Section, Chapter 4, dealing with ice, cold, and limited daylight conditions. Individual resources potentially impacted by a catastrophic discharge event (CDE), including those in Alaska, are discussed in the Potential Impacts per Resource Area Section, Chapter 4. This analysis of potential impacts is broad and considers entire planning areas. At subsequent lease sale stages, more specific information will be available regarding the location and level of activity, spill risk of proposed activities, and specific environmental resources in the area. At subsequent stages, BOEM might also conduct Oil Spill Risk Analysis modeling to better estimate spill risk, spill trajectories, and probability of contact with an environmental resource. Spill response methods and specifics would be analyzed in more detail in the individual lease sale stage environmental review documents as well as in spill response plans submitted as part of lessees' Exploration Plans and Development and Production Plans.

Comment ID	Commenter	Comment	Response
32	Kory Blake	In the Chukchi and Beaufort Seas how do the oil companies plan to clean up a spill on or under the ice? Do they have a plan and is it a workable plan?... Cook Inlet has the largest tides in the world… how can they protect our environment when they can't contain oil in any of their clean up equipment?	The PEIS identifies and discusses the differences and challenges of spill response in the Alaskan environment in the Accidental Spills and Catastrophic Discharge Events Section, Chapter 4, dealing with ice, cold, and limited daylight conditions. Individual resources potentially impacted by a catastrophic discharge event (CDE), including those in Alaska, are discussed in the Potential Impacts per Resource Area Section, Chapter 4. This analysis of potential impacts is broad and considers entire planning areas. At subsequent lease sale stages, more specific information will be available regarding the location and level of activity, spill risk of proposed activities, and specific environmental resources in the area. At subsequent stages, BOEM might also conduct Oil Spill Risk Analysis modeling to better estimate spill risk, spill trajectories, and probability of contact with an environmental resource. Spill response methods and specifics would be analyzed in more detail in the individual lease sale stage environmental review documents as well as in spill response plans submitted as part of lessees' Exploration Plans and Development and Production Plans.
444	Kotzebue Meeting Transcription	Oil spills would be devastating for communities and subsistence.	The PEIS identifies and discusses the differences and challenges of spill response in the Alaskan environment in the Accidental Spills and Catastrophic Discharge Events Section, Chapter 4, dealing with ice, cold, and limited daylight conditions. Individual resources potentially impacted by a catastrophic discharge event (CDE), including those in Alaska, are discussed in the Potential Impacts per Resource Area Section, Chapter 4. This analysis of potential impacts is broad and considers entire planning areas. At subsequent lease sale stages, more specific information will be available regarding the location and level of activity, spill risk of proposed activities, and specific environmental resources in the area. At subsequent stages, BOEM might also conduct Oil Spill Risk Analysis modeling to better estimate spill risk, spill trajectories, and probability of contact with an environmental resource. Spill response methods and specifics would be analyzed in more detail in the individual lease sale stage environmental review documents as well as in spill response plans submitted as part of lessees' Exploration Plans and Development and Production Plans.

Comment ID	Commenter	Comment	Response
385	Kristen Avery, Wildlife Conservation Society	The Final PEIS should fully consider the impacts of offshore oil and gas exploration and development, particularly the cumulative impacts on whales and other marine mammals. The Draft PEIS does point to concerns for marine mammals, but the PEIS should include more thorough analyses using the most up-to-date and best scientific information and data.	The cumulative impacts analysis has been reviewed and revised, as appropriate. BOEM reviewed the most recent and best available science necessary to reasonably describe potential impact pathways and effects relevant to the Proposed Action. The level of analysis in the PEIS is consistent with recent CEQ guidance on programmatic reviews (CEQ 2014). The analysis is presented at a national level, and therefore, the context and intensity of impacts are described broadly. If a decision is made to move forward with any of the proposed lease sales included in the Program schedule, additional environmental review will take place before any individual lease sale and will consider in more detail impacts to ESA listed and non-listed species, including whales and other marine mammals. More detailed assessment of cumulative impacts on marine mammals will be included in lease-sale or activity-specific NEPA documents prepared by BOEM.
406	Kristen Monsell, Center for Biological Diversity	Despite acknowledging that the Proposed Action will increase global GHG emissions, BOEM wholly failed to quantify the costs of such emissions or consider the impacts of consuming the oil and gas that could be developed under the Five Year Program. BOEM's Draft PEIS wholly fails to consider the climate impacts of burning the oil and gas extracted under the Five Year Program and its impacts on our ability to limit the most catastrophic impacts of climate change. In evaluating the environmental impacts of the Proposed Action, NEPA requires BOEM to consider and describe the direct and indirect impacts. But BOEM wholly failed to consider the impacts of these emissions or how allowing offshore oil and gas leases in federal waters will impact our ability to limit warming to 1.5 or 2 ^{o}C consistent with the Paris Agreement.	On August 1, 2016, CEQ issued Final Guidance for the Consideration of Greenhouse Gas Emissions and the Effects of Climate Change in National Environmental Policy Act Reviews. The Final PEIS addresses the effects of climate change consistent with that guidance. BOEM has also quantified downstream greenhouse gas emissions as a proxy for assessing climate change effects. BOEM recognizes the broad emissions reduction targets specified in the 2015 Paris Agreement and wholly understands that future climate policy measures may change the demand for and supply of fossil fuels. BOEM's analytical assumptions in the PEIS are consistent with authoritative projections from the U.S. Department of Energy, Energy Information Administration; those projections about future demand and supply are based on current laws and regulations. The 2017-2022 Program only proposes a schedule of potential oil and gas lease sales consistent with the requirements of OCSLA; a given program decision does not make an irretrievable commitment to hold the sales and does not guarantee oil and gas production or downstream consumption. Because of the protracted time frame (approximately 70 years) under consideration, it is even possible that production may not occur or could be greatly reduced at some point in the future given new laws or policies, or technologies or alternative sources of energy. The No Action Alternative broadly contemplates what would happen if there were no new OCS leasing and discusses a range of possible energy substitutes to meet future energy demand, including conservation and renewable energy. BOEM does not speculate how the Proposed Action or No Action Alternatives could be affected depending on how the U.S. achieves emission reduction targets.

Comment ID	Commenter	Comment	Response
408	Kristen Monsell, Center for Biological Diversity	BOEM failed to take a hard look at the direct, indirect and cumulative impacts of oil spills.	The cumulative impacts analysis has been updated to include additional resource-specific information. The level of analysis presented is appropriate for a programmatic EIS. More detailed site-specific assessments of direct and cumulative impacts from spills will be included in lease-, or activity-specific NEPA documents prepared by BOEM. Catastrophic Discharge Events (CDEs) in the PEIS are not arbitrarily dismissed from consideration and are addressed and evaluated in Chapter 4 along with accidental spills for each of resource. Challenges and limitations of oil spill response in the Artic are discussed in the Potential Impacts per Resource Area Section (Chapter 4); this includes difficulties from remote access, lack of infrastructure, shallow water limitations, and icy conditions resulting in greater impacts from a potential accidental spill or CDE in the Arctic. Overall impacts on land use and infrastructure were determined to range from minor to major depending on the location, timing, and magnitude of the event, as well as the effectiveness of the containment and cleanup activities. Spills from pipelines and vessels transporting oil are evaluated in Section 4.5, Cumulative Impacts. Additionally, oil spills evaluated include spills from pipelines and transport vessels.
410	Kristen Monsell, Center for Biological Diversity	BOEM failed to take a hard look at the direct, indirect and cumulative impacts to imperiled wildlife. There are several ESA-listed species in the Arctic, Cook Inlet, and Gulf of Mexico that will be negatively impacted by increased offshore oil and gas exploration, development and production. But BOEM’s Draft PEIS fails to take a hard look at the impacts of its Program on these already imperiled species, some of which are among the most endangered species on the planet.	Programmatic and tiered analyses differ in their focus and scope (CEQ 2014). At the programmatic level, analysis is at the macroscopic, landscape or (in this case) national level. The description of potential impacts on all ESA listed and non-listed species is broad in scale and magnitude. The level of analysis is concise and introduces potential impact producing factors for all regions and species at a national level. If a decision is made to move forward with any of the proposed lease sales in the Proposed Five Year Program, additional reviews will take place that will be more site-specific and will analyze impacts to ESA listed and non-listed species in greater detail.
415	Kristen Monsell, Center for Biological Diversity	BOEM failed to consider an adequate range of reasonable alternatives and failed to appropriately consider the No Action Alternative.	The alternatives analyzed in this PEIS present a range of reasonable alternatives to meet the Purpose and Need identified at the beginning of Chapter 1, and the activities corresponding to each alternative are analyzed in view of current environmental standards. BOEM has reviewed the No Action Alternative assumptions and effects analyses and has ensured adequate consideration of the potential impacts. The document has been revised to include resource specific discussions of the potential impacts of the No Action Alternative.

Comment ID	Commenter	Comment	Response
417	Kristen Monsell, Center for Biological Diversity	BOEM Failed to Properly Define the Environmental Baseline. BOEM's environmental baseline is inadequate, both regarding the Arctic and the Gulf of Mexico. As we have discussed at length in numerous comments over many years, there are significant data gaps regarding the Arctic environment and how it will be affected by offshore oil development. Despite promises to the contrary, BOEM continues to: (1) fail to gather necessary data and scientific information about resources, risks, environmental sensitivities, and spill response capabilities in the Arctic; and (2) proceed with the leasing process and the authorization of on-site drilling despite enormous information gaps concerning these critical issues. Moreover, BOEM has repeatedly admitted in other environmental review documents that there are data gaps regarding numerous resources in the Gulf of Mexico, including wetlands, coastal water quality, offshore water quality, air quality, commercial and recreational fishing and environmental justice, and that the impacts of the Deepwater Horizon oil spill on such resources may have changed baseline conditions. BOEM therefore cannot properly define the environmental baseline, but it is arbitrarily proceeding to allow substantially more offshore oil and gas drilling regardless.	The description of the affected environment (commenter's "baseline") is an appropriate level of detail for a programmatic analysis. BOEM acknowledges data gaps and addresses them as appropriate under 40 CFR 1502.22. The information provided is sufficient to the decision at hand and additional information will be considered as appropriate at subsequent stages. BOEM supports a substantial studies program and invests over thirty million dollars per year in studies designed to address data gaps in information about resources in the OCS environment. In addition, BOEM and BSEE conduct extensive research with regard to oil spill prevention and clean up and advancing newer and safer technologies. BOEM considered the DWH Natural Resource Damage Assessment Final Programmatic Damage Assessment and Restoration Plan and Final Programmatic EIS (PDARP/PEIS 2016) and this document is incorporated by reference into the PEIS.

Comment ID	Commenter	Comment	Response
418	Kristen Monsell, Center for Biological Diversity	BOEM failed to take a hard look at the direct, indirect and cumulative impacts from offshore fracking and acidizing. BOEM has previously acknowledged that offshore fracking and acidizing are used at platforms in the Gulf of Mexico and offshore fracking is increasingly being used by oil and gas companies in Alaskan waters. These practices cause environmental damages beyond those of conventional offshore oil and gas development by producing water and air pollution, increasing the risk of earthquakes and oil spills, and prolonging the life of aging infrastructure and our use of dirty fossil fuels. But BOEM wholly ignores the impacts that could occur from these dangerous practices in its Draft PEIS. While BOEM does not analyze the impacts of fracking wastewater discharges, it dismisses the import of produced water discharges generally because the discharge is regulated by Clean Water Act permits issued by USEPA. But BOEM ignores the fact that the permit contains no real limit on the quantity of fracking or acidizing chemicals that can be discharged. Moreover, an agency cannot excuse itself from its NEPA hard look duty because a facility operates pursuant to a permit or because the impacts have been discussed in a non-NEPA document. The failure to take a hard look at the impacts of offshore fracking and acidizing violates NEPA.	Well completion and stimulation operations have taken place on the Gulf of Mexico (GOM) and Pacific Outer Continental Shelf (OCS) for decades (however, none have occurred on the Alaska OCS). Well stimulation treatments could include hydraulic fracturing and non-fracturing techniques; however, offshore hydraulic fracturing techniques are distinctly different in scale and risk from onshore operations. For example, fluid volumes and fracturing radii are orders of magnitude less in offshore operations compared to onshore operations, and no seismic events or risk to fresh water aquifers have been detected as a result of these offshores activities. In the 2017-2022 PEIS, BOEM addresses discharges from these operations in the sections that discuss water quality (i.e., produced water) and air quality (i.e., air emissions). Potential impacts of these operations are also more appropriately analyzed in greater detail at the regional level (for the Pacific Region) in a joint BOEM-BSEE Final Programmatic Environmental Assessment (EA) of the Use of Well Stimulation Treatments in the Southern California Outer Continental Shelf (May 2016) (http://pocswellstim.evs.anl.gov/) and (in the GOM Region) in every Multi-Lease Sale EIS and subsequent Lease Sale documents. Well completion and stimulation operations are subject to the same water quality and air quality requirements and reviews as other oil and gas activities. Both USEPA Regions 4 and 6 prohibit the discharge of well-treatment, completion, and workover fluid with additives containing priority pollutants. If well treatment, workover, and completion chemicals are discharged with the drilling muds and cuttings or with the produced-water streams, these discharges must meet the general toxicity limits in the NPDES general permit. Discharge and monitoring records must be kept, and the permit requirements are inspected and enforced by BSEE.

Comment ID	Commenter	Comment	Response
419	Kristen Monsell, Center for Biological Diversity	NEPA's implementing regulations provide that an environmental document should specify the underlying Purpose and Need to which the agency is responding in proposing the alternative including the Proposed Action. This Purpose and Need inquiry is crucial for a sufficient environmental analysis because "[t]he stated goal of a project necessarily dictates the range of 'reasonable' alternatives." Thus, "an agency cannot define its objectives in unreasonably narrow terms" without violating NEPA. BOEM's Purpose and Need is entirely inadequate because BOEM necessarily considered an unreasonably narrow range of alternatives.	Per Section 18 of OCSLA, BOEM is required to develop a schedule of oil and gas lease sales on the OCS for 5-year periods. Thus OCSLA is the implementing legislation driving the Purpose, and it is the law requiring the Secretary of the Interior to propose an action. The Need is founded in the sources of energy consumption in the United States which were presented in the Draft PEIS. Recognizing that, President Obama's energy strategy is "All of the Above," which includes oil and gas and fits with OCSLA mandates as well. The Proposed Action under NEPA as analyzed in the Draft PEIS is the schedule of lease sales in the 2017-2022 DPP, and the Draft PEIS determined possible environmental impacts of the proposed lease sale schedule (Proposed Action) in comparative form to other lease sale schedule alternatives allowable under Section 18 of OCSLA, including the No Action Alternative (no lease sales for the OCS in 2017-2022). Thus the Secretary of the Interior has the ability to choose any of the alternatives including the No Action Alternative after weighing possible benefits and adverse environmental impacts. NEPA requires that agencies shall propose actions, and alternatives to that action, that meet the Purpose and Need. This means that decisions outside the scope of Section 18 of OCSLA and outside of the Purpose and Need for action cannot be considered as reasonable alternatives (e.g., renewable energy substitutions, energy efficiency measures, adding back in areas that have been removed from consideration under the Program).
420	Kristen Monsell, Center for Biological Diversity	BOEM failed to take a hard look at the direct, indirect and cumulative impacts from greenhouse emissions and climate change. Despite acknowledging that "the Proposed Action will increase global GHG emissions," BOEM wholly failed to quantify the costs of such emissions or consider the impacts of consuming the oil and gas that could be developed under the Five Year Program. Moreover, while BOEM includes some discussion of the impacts of climate change, that analysis is entirely cursory and fails to adequately describe baseline conditions or even acknowledge how climate change will directly impact oil and gas infrastructure. Such failures violate NEPA. BOEM's Draft PEIS fails to consider the impacts of consuming the oil and gas extracted under the program. BOEM failed to adequately consider the impacts of climate change on the ocean environment. BOEM failed to adequately analyze the impacts of ocean acidification.	On August 1, 2016, CEQ issued Final Guidance for the Consideration of Greenhouse Gas Emissions and the Effects of Climate Change in National Environmental Policy Act Reviews. The Final PEIS addresses the effects of climate change consistent with that guidance, including describing the sensitivity of resources to future impacts because of changing climate. BOEM has also quantified downstream greenhouse gas emissions as a proxy for assessing climate change effects. BOEM has included or expanded discussion of ocean acidification in Chapter 4 where appropriate.

Comment ID	Commenter	Comment	Response
421	Kristen Monsell, Center for Biological Diversity	BOEM failed to adequately analyze the impacts of black carbon emissions.	Black carbon emissions are approximated through a conservative approximation of Fine Particulate Matter (PM2.5). This analysis includes a discussion of the impacts of black carbon, and the expected amount of emissions of PM2.5 in the Proposed Action. This discussion can be found in Section 4.2.1 of the EIS.
422	Kristen Monsell, Center for Biological Diversity	While BOEM includes some discussion of the impacts of climate change, that analysis is entirely cursory and fails to adequately describe baseline conditions or even acknowledge how climate change will directly impact oil and gas infrastructure. Such failures violate NEPA. Changing conditions in the Arctic because of climate change have the potential to profoundly affect offshore oil and gas infrastructure. While BOEM admits that changes in permafrost have caused failure of buildings and costly increases in road maintenance in Alaska due to their damage, it does not analyze how permafrost melt, coastal erosion or sea level rise will affect oil and gas infrastructure and the safety (or lack thereof) of such operations. The failure to do so violates NEPA. In addition to impacts on Arctic oil and gas drilling operations, climate change could also impact infrastructure in the Gulf of Mexico through increases the frequency and severity of storms, including hurricanes. While BOEM's analysis admits that hurricanes and other extreme weather events can damage pipelines and infrastructure resulting in a release of oil, BOEM's analysis fails to analyze how increased storm severity in the face of climate change will increase the risks of oil spills, accidents and other environmental harms associated with offshore oil and gas drilling in the Gulf of Mexico. The failure to do so violates NEPA.	On August 1, 2016, CEQ issued Final Guidance for the Consideration of Greenhouse Gas Emissions and the Effects of Climate Change in National Environmental Policy Act Reviews. The Final PEIS addresses the effects of climate change consistent with that guidance, including describing the sensitivity of resources to future impacts because of changing climate.

Comment ID	Commenter	Comment	Response
423	Kristen Monsell, Center for Biological Diversity	BOEM’s Draft PEIS ignores the social cost of carbon from the cumulative contribution of increased oil and gas development and related effects on climate change. The Draft PEIS also arbitrarily ignores the social cost of carbon tool to analyze the emissions it admits will be caused by the Program and the emissions generated through burning the oil and gas extracted under the Program. Although a cost-benefit analysis is not necessarily the ideal or exclusive method for assessing contributions to an adverse effect as enormous and potentially catastrophic as climate change, BOEM does have tools available to provide one approximation of external costs of the social cost of carbon. The social cost of carbon was developed by the Interagency Working Group on Social Cost of Carbon, which was convened by the Council of Economic Advisers and the Office of Management and Budget. In short, leasing and development of oil and gas wells could exact extraordinary financial costs to communities and future generations, setting aside the immeasurable loss of irreplaceable, natural values that can never be recovered. BOEM's environmental review must provide an accounting of these potential harms and costs, including the SCC. Its failure to do so violates NEPA.	BOEM has estimated the downstream greenhouse gas emissions related to the consumption of OCS oil and gas consistent with the Council on Environmental Quality's Final Guidance issued in August 2016. BOEM has prepared a separate technical report (available at www.boem.gov) that estimates upstream and downstream emissions in context of ongoing OCS Program oil and gas activities. The Final PEIS incorporates by reference and summarizes that analysis. CEQ regulations or the new guidance from CEQ do not expressly require the monetization of cost and benefits. BOEM has estimated the social cost of carbon in the separate technical report, and then summarized and referenced that broader analysis, as appropriate, in the PEIS or in other Program documents.

Comment ID	Commenter	Comment	Response
424	Kristen Monsell, Center for Biological Diversity	BOEM's Draft PEIS fails to take a hard look at the impacts of an oil spill by arbitrarily dismissing consideration of the impacts of a catastrophic oil spill, and by failing to consider the dangers of transporting oil and gas. BOEM's failures violate NEPA.	Challenges and limitations of oil spill response in the Arctic are discussed in the Accidental Spills and Catastrophic Discharge Events Section of the PEIS. This includes difficulties from remote access, lack of infrastructure, shallow water limitations, and icy conditions resulting in greater impacts from a potential accidental spill or catastrophic discharge event in the Arctic. Consideration was given to these concerns at a programmatic level and more detailed analyses of these concerns were cited (NRC 2014). In addition, evaluations included consideration of fate and transport of oil, region-specific physical and environmental factors, and potential impacts for each evaluated resource. Potential impacts from accidental spills and unexpected catastrophic discharge events (CDE) for each resource was given a rating ranging from negligible to major based on the evaluation. Through the scoping process, BOEM actively solicited the most recent and available science/data necessary to effectively describe all potential impact pathways relevant to the Proposed Action. The level of analysis in the PEIS is in compliance with recent CEQ guidance on programmatic reviews (CEQ 2014) and is an appropriate level of detail for the decision at hand. The analysis is at a national level, and the scope of impacts is described broadly. If a decision is made to move forward with any of the proposed lease sales in the Proposed Five Year Program, additional reviews will take place that will be more site-specific and will analyze impacts on ESA listed and non-listed species in greater detail. Subsequent incremental NEPA documents will be written at the individual lease sale level.
426	Kristen Monsell, Center for Biological Diversity	While BOEM considered limiting drilling in certain areas within the Beaufort, Chukchi, Cook Inlet and Atlantic, BOEM did not consider an alternative that would limit drilling in the Gulf of Mexico. For example, BOEM failed to examine an alternative that would prohibit new oil and gas leases in designated critical habitat for the Northwest Atlantic loggerhead sea turtle distinct population segment, or other biologically important areas in the Gulf of Mexico. BOEM also failed to consider an alternative that would prohibit new oil and gas leases in the Mississippi Canyon—the site of the Deepwater Horizon catastrophe. BOEM also failed to examine alternatives that would otherwise limit development and production activities under the Five Year Program, such as an alternative that would limit the number of wells that could be drilled under the Program or an alternative that would prohibit the use of particularly dangerous drilling activities such as offshore fracking and acidizing. BOEM also failed to consider an alternative that would end all new offshore oil and gas leasing pending a plan to limit warming to 1.5º or 2ºC.	A discussion on the topographic stipulations in the Gulf of Mexico is included in the PEIS. Effects of no new leasing are analyzed under the No Action Alternative. Due to the expansive areal extent of loggerhead sea turtle critical habitat in the GOM, excluding all such areas is effectively considered under the No Action Alternative. None of the Biologically Important Areas occur within the GOM Program Area and therefore do not constitute a reasonable alternative. BOEM did consider excluding the Mississippi Canyon from oil and gas leasing but did not carry it forward for further detailed analysis as discussed in the Alternatives Considered but Eliminated from Programmatic Consideration. Consideration of alternatives that limit specific activities are more appropriate for analysis at later stages.

Comment ID	Commenter	Comment	Response
427	Kristen Monsell, Center for Biological Diversity	In addition, BOEM's analysis of the No Action Alternative is fundamentally flawed. Specifically, BOEM illogically concludes that the No Action Alternative will have more negative impacts than all of the action alternatives. To reach this conclusion, BOEM assumes that the nation will conduct business as usual for the next 70-years—in other words, that future energy needs will mirror historical energy trends. Accordingly, oil and gas that would have been extracted under the Five Year Program would be substituted by oil, gas or other fuels obtained onshore or through imports which create greater risk of harm to the environment and public health. But it is wholly unreasonable to assume that laws in place prior to the start of the Five Year Program will govern through the next seven decades, particularly considering that the United States has committed to limit global warming to 1.5ºC or 2ºC above pre-industrial levels consistent with the Paris Agreement.	The document has been revised to include resource-specific discussions of the potential impacts of the No Action Alternative. BOEM has reviewed the No Action Alternative assumptions and effects analyses and has ensured adequate consideration of the potential impacts. The Department of Energy's Energy Information Administration is the principal Federal agency responsible for collecting, analyzing, and disseminating energy information to promote sound policymaking, efficient markets, and public understanding of energy and its interaction with the economy and the environment. The EIA forecasts future energy demand and supply based on current laws and regulations. BOEM relies on special runs performed by the EIA's National Energy Modeling System (NEMS) to feed its MarketSim model that in turn is used to determine changes in energy demand and energy substitutes under the No Action Alternative.
428	Kristen Monsell, Center for Biological Diversity	This flawed analysis also led BOEM to inappropriately reject consideration of a renewable energy alternative, such as leasing the OCS for offshore wind, rather than oil and gas.	BOEM uses the demand projections from the USEIA, which are the official U.S. government projections, and are therefore appropriate to include in this analysis. BOEM has an OCS Renewable Energy Program currently leasing areas for OCS wind development, which is a subset of its overall regulatory purview for renewable energy. BOEM's market substitution analysis supports not separately analyzing alternative energy as a reasonable alternative to some or all oil and gas OCS development. Renewable energy would only account for less than three percent of the energy resource not produced as a result of no lease sales being held in the 2017-2022 Oil and Gas Program.

Comment ID	Commenter	Comment	Response
429	Kristen Monsell, Center for Biological Diversity	BOEM also appears at times to have rejected consideration of such [renewable energy] alternatives because it claims that it is not aware of any specific plans to develop renewable energy projects in certain program areas within the 2017-2022 time frame. But elsewhere in the document BOEM specifically lists certain renewable energy projects that are being developed or could be developed in the foreseeable future, including several tidal projects near Cook Inlet, pilot tidal and wind projects in the Gulf of Mexico, and pilot wind projects in the Atlantic. And BOEM cannot artificially truncate its analysis regarding the viability of such projects at the next five years considering that BOEM's Five Year Program will affect offshore oil and gas development for up to the next 70 years.	Renewable energy alternatives are not analyzed because they do not meet the Purpose and Need. OCSLA specifically mandates the development of an OCS oil and gas program every five years. The alternatives analyzed in this PEIS present a range of reasonable alternatives to meet the Purpose and Need identified at the beginning of Chapter 1, and the activities corresponding to each alternative are analyzed in view of current environmental standards. BOEM uses the demand projections from the USEIA, which are the official U.S. government projections, and are therefore appropriate to include in this analysis. Renewable energy development is not yet a substitute for oil and gas development. The role of energy conservation and renewable energy sources in meeting the energy demands of this country continues to grow. Such sources, however, could not replace the energy supplied by oil and gas from OCS sources in the near term. BOEM has an offshore renewable energy program committed to orderly, safe, and environmentally responsible renewable energy development activities. OCSLA mandates that the management of the OCS be conducted in a manner which considers economic, social, and environmental values of both the renewable and nonrenewable resources contained in the Outer Continental Shelf.
430	Kristen Monsell, Center for Biological Diversity	BOEM's analysis of cumulative impacts is nothing more than general statements and a list of activities in the area that affect the environment. For example, the cumulative impacts "analysis" of air quality consists a list of broad categories of activities such as "ongoing and future oil and gas exploration, development and production onshore and in state, Mexican, Canadian, and Russian waters" that have air quality impacts. It failed to mention or analyze the impacts from specific activities or projects, such as the Delfin LNG project, a floating offshore LNG facility recently proposed in the Gulf of Mexico, which would emit greenhouse gases, increase the use of fracking and exacerbate the impacts of climate change. Moreover, BOEM wholly failed to actually analyze the impacts of the Proposed Action in light of these other activities because non-OCS activities, particularly in the Gulf of Mexico, generate more emissions than OCS activities. NEPA requires agencies to consider all the significant impacts of cumulative actions; it does not excuse consideration of one impact simply because another impact may be more significant. BOEM's meager list of categories of activities and their impacts wholly fails to conduct a "quantified assessment of their [other projects] combined environmental impacts," and "objective quantification of the impacts" from other existing and proposed activities in the region, as required by NEPA.	BOEM has revised the cumulative effects analysis to provide more context and support for conclusions about any incremental contribution to potentially significant cumulative effects. The level of analysis in the PEIS is in compliance with recent CEQ guidance on programmatic reviews (CEQ 2014) and is an appropriate level of detail for the decision at hand. The analysis is at a national level, and the scope of impacts is described broadly. If a decision is made to move forward with any of the proposed lease sales in the Proposed Five Year Program, additional reviews will take place that will be more site-specific and will analyze impacts on ESA listed and non-listed species in greater detail. Subsequent incremental NEPA documents will be written at the individual lease sale level. A more thorough site-specific analysis of cumulative impacts will be undertaken at the lease sale level, should a proposed lease move forward.

Comment ID	Commenter	Comment	Response
431	Kristen Monsell, Center for Biological Diversity	BOEM failed to adequately consider environmental justice issues. From air pollution to subsistence hunting and fishing, BOEM's proposal raises significant environmental justice issues. But BOEM's Draft PEIS fails to adequately address these significant impacts.	Information specific to impact producing factors can be found in Chapter 4, Environmental Justice Section. The level of analysis presented in Chapter 4 of the PEIS analyzing potential impacts related to Environmental Justice is appropriate for a programmatic EIS. More thorough assessments of impacts related to Environmental Justice issues will be included in lease-, or activity-specific NEPA documents prepared by BOEM. BOEM consulted (and continues to consult) with Federally recognized Tribes and Alaska Natives early in the development of the PEIS. Onshore support activities resulting from OCS Oil and Gas activities were also analyzed in the PEIS.
432	Kristen Monsell, Center for Biological Diversity	BOEM's analysis of the cumulative impacts of its proposal on environmental justice communities is inadequate. Indeed, BOEM seems to dismiss the import of the additional air pollution that could result from the Five Year Program on Gulf communities because there is already significant OCS-related infrastructure in the Gulf states. This approach undercuts the entire purpose of a cumulative impacts analysis and efforts to inform and engage environmental justice communities.	New text has been added to the Environmental Justice Section in Chapter 4 to address cumulative air quality impacts that could be disproportionally felt by minority or low income individuals or communities.
601	Kristen Monsell, Center for Biological Diversity	Further, while BOEM reinitiated Section 7 consultation under the ESA following the Deepwater Horizon oil spill, BOEM has yet to complete that consultation. Accordingly, BOEM does not have an accurate picture of the effects that authorizing more offshore oil and gas drilling (including in the very same area where the Deepwater Horizon spill occurred) could have on already imperiled species. BOEM cannot conduct a proper NEPA analysis unless and until these significant data gaps are filled.	Section 7 consultation under the ESA is an iterative process. BOEM has provided biological assessments to the Services and is working with NMFS and USFWS to finalize biological opinions. Through the ESA process, new mitigation measures may be designated to minimize impacts to listed species, but ESA consultations do not generally result in new scientific information. BOEM will continue to work with the Services at all stages of leasing to ensure the best possible practices to protect endangered species.
602	Kristen Monsell, Center for Biological Diversity	In addition to failing to address the impacts of consuming the oil and gas extracted under the Program, BOEM fails to adequately describe baseline conditions related to climate change or consider the impacts of climate change on the ocean environment. While BOEM's analysis acknowledges that climate change is occurring, its analysis is cursory and fails to properly disclose the enormity of the problem, or the contribution of the Five Year Program to the problem. For example, BOEM fails to adequately analyze the impacts of ocean acidification and black carbon emissions over the course of the Program, and the Program's contribution to these significant environmental problems.	On August 1, 2016, CEQ issued Final Guidance for the Consideration of Greenhouse Gas Emissions and the Effects of Climate Change in National Environmental Policy Act Reviews. The Final PEIS addresses the effects of climate change consistent with that guidance, including describing the sensitivity of resources to future impacts because of a changing climate. Black carbon emissions, which the CEQ guidance does not address, are approximated through a conservative approximation of Fine Particulate Matter (PM2.5) in the Climate Change discussion (Issues of Programmatic Concern Chapter 4). This analysis includes an explanation of the impacts of black carbon, and the expected amount of emissions of PM2.5 in the Proposed Action. Additionally, BOEM has expanded the relevant resource sections to include additional information, as needed, on how the impacts of the Proposed Action could be further compounded due to climate change, including oil and gas infrastructure, water quality, benthic communities, and marine mammals.

Comment ID	Commenter	Comment	Response
457	Center for Biological Diversity; Chukchi Sea Watch; Earthjustice; Friends of the Earth; Greenpeace USA; Natural Resources Defense Council; Northern Alaska Environmental Center; Pacific Environment; Sierra Club; The Wilderness Society	Therefore, we respectfully request a 45-day extension of the deadline for comments on the DPEIS, through June 16, 2016, to match the Proposed Program comment period.	On March 18, 2016, BOEM published a Notice of Availability of the Draft PEIS for the 2017-2022 Oil and Gas Leasing Program. NEPA requires a minimum 45-day comment period on Draft PEIS documents, a period which may be extended at the discretion of the agency issuing the document. In the case of the Five Year Draft PEIS, BOEM determined that 45 days was adequate and appropriate for a programmatic document. However, all stakeholders were encouraged to provide comments on the 2017-2022 Proposed Program during the comment period, which ended June 16, 2016. BOEM recognizes the importance of input from public stakeholders, and appreciates the timing constraints noted by the commenter.
435	Lois Epstein, The Wilderness Society	Should the agency continue to entertain development in the Arctic, we believe coastal buffer zones of up to 50 miles for both the Chukchi and Beaufort Seas should be established where lease sales would not occur to protect coastal resources in a manner consistent with current Department of the Interior policy and executive order.	A 50-mile buffer in the Beaufort Sea Program Area would not constitute a reasonable alternative due to the fact that it would make most of the hydrocarbon resource play area unavailable for leasing; it is effectively the same as the No Action Alternative for the Beaufort Sea. In the Chukchi Sea, a 25-mile buffer already exists as a Presidential Withdrawal. In the PEIS, BOEM has considered an expansion of this area out to 50 miles within which mitigation could reduce impacts on species and habitats in this area.
436	Lois Epstein, The Wilderness Society	Assuming that fossil fuel use in the United States will continue on a business-as-usual trajectory, which ignores the country's commitment in Paris in 2015 to reduce carbon emissions, the Draft PEIS failure to assess how oil and gas produced and burned as a result of 2017-2022 lease sales would contribute to climate change. The Draft PEIS failure to account for the social costs of carbon emissions, and the lack of analysis on how climate change and the region's industrialization resulting from the lease sales would synergistically increase stress on Arctic wildlife over a 70 year period.	On August 1, 2016, the Council on Environmental Quality issued Final Guidance for the Consideration of Greenhouse Gas Emissions and the Effects of Climate Change in National Environmental Policy Act Reviews. The Final PEIS addresses the effects of climate change consistent with that guidance, including describing the sensitivity of resources to future impacts because of a changing climate. BOEM has also quantified downstream greenhouse gas emissions as a proxy for assessing climate change effects. CEQ regulations or the new guidance from CEQ do not expressly require the monetization of cost and benefits. BOEM has estimated the social cost of carbon in a separate technical report (available at www.boem.gov), and then summarized and referenced that broader analysis, as appropriate, in the PEIS or other Program documents.

Comment ID	Commenter	Comment	Response
562	Lois Epstein, The Wilderness Society	The Draft PEIS fails to address problems of spill response efficacy in a realistic fashion. Arctic conditions make recovery of significant quantities of oil even less likely, and the lack of infrastructure only exacerbates this problem. These differences are relevant to BOEM's decisions regarding which areas of the country should be included in the five-year program, and they must be examined in the Final PEIS.	The PEIS identifies and discusses the differences and challenges of spill response in the Alaskan environment in the Accidental Spills and Catastrophic Discharge Events Section, Chapter 4, dealing with ice, cold, and limited daylight conditions. Individual resources potentially impacted by a catastrophic discharge event (CDE), including those in Alaska, are discussed in the Potential Impacts per Resource Area Section, Chapter 4. This analysis of potential impacts is broad and considers entire planning areas. At subsequent lease sale stages, more specific information will be available regarding the location and level of activity, spill risk of proposed activities, and specific environmental resources in the area. At subsequent stages, BOEM might also conduct Oil Spill Risk Analysis modeling to better estimate spill risk, spill trajectories, and probability of contact with an environmental resource.
563	Lois Epstein, The Wilderness Society	The Draft PEIS also fails to address the unique nature of the Arctic Ocean's oil spill response gap. In deciding whether to include the Arctic Ocean in the Five Year Program, BOEM needs to take the response gap's impacts into account in the Final PEIS. For example, the Final PEIS should address how much longer it will take additional resources to arrive in the Arctic Ocean in the event of an emergency compared to the rest of the country, and the resulting consequences on Arctic communities and the environment including protected federal lands.	The PEIS identifies and discusses the differences and challenges of spill response in the Alaskan environment in the Accidental Spills and Catastrophic Discharge Events Section, Chapter 4, dealing with ice, cold, and limited daylight conditions. Individual resources potentially impacted by a catastrophic discharge event (CDE), including those in Alaska, are discussed in the Potential Impacts per Resource Area Section, Chapter 4. This analysis of potential impacts is broad and considers entire planning areas. At subsequent lease sale stages, more specific information will be available regarding the location and level of activity, spill risk of proposed activities, and specific environmental resources in the area. At subsequent stages, BOEM might also conduct Oil Spill Risk Analysis modeling to better estimate spill risk, spill trajectories, and probability of contact with an environmental resource. Spill response methods and specifics would be analyzed in more detail in the individual lease sale stage environmental review documents as well as in spill response plans submitted as part of lessees' Exploration Plans and Development and Production Plans.

Comment ID	Commenter	Comment	Response
564	Lois Epstein, The Wilderness Society	An oil spill in the Chukchi or Beaufort Sea would have significant impacts on people, mammals, bird life, and wildlife habitats, including in some instances population-level effects on wildlife. The inefficiencies inherent in spill response efforts in the icy waters of the Arctic Ocean exacerbate these problems and, therefore, BOEM must analyze these differential effects when deciding whether to include the Arctic Ocean in the Five Year Program.	The PEIS identifies and discusses the differences and challenges of spill response in the Alaskan environment in the Accidental Spills and Catastrophic Discharge Events Section, Chapter 4, dealing with ice, cold, and limited daylight conditions. Individual resources potentially impacted by a catastrophic discharge event (CDE), including those in Alaska, are discussed in the Potential Impacts per Resource Area Section, Chapter 4. This analysis of potential impacts is broad and considers entire planning areas. At subsequent lease sale stages, more specific information will be available regarding the location and level of activity, spill risk of proposed activities, and specific environmental resources in the area. At subsequent stages, BOEM might also conduct Oil Spill Risk Analysis modeling to better estimate spill risk, spill trajectories, and probability of contact with an environmental resource. Spill response methods and specifics would be analyzed in more detail in the individual lease sale stage environmental review documents as well as in spill response plans submitted as part of lessees' Exploration Plans and Development and Production Plans.
566	Lois Epstein, The Wilderness Society	In the Draft PEIS, BOEM designates climate change to be an Issue of Programmatic Concern and concludes from its analysis that “the Proposed Action will increase global [greenhouse gas] emissions.” The Draft PEIS, however, only assesses the climate effects of activities in the program areas related to the exploration, production, and transport of oil and gas. It does not assess the effects of consuming oil and gas produced from the program areas. Simply put, the agency’s failure to analyze the effects of burning oil and gas produced from the program areas obfuscates the very subject of the test laid out in the Joint Agreement. The burning of the fossil fuels produced by this Program is a reasonably foreseeable consequence of the decision to include an area in the Program in the first place, and must be analyzed and disclosed.	On August 1, 2016, the Council on Environmental Quality issued Final Guidance for the Consideration of Greenhouse Gas Emissions and the Effects of Climate Change in National Environmental Policy Act Reviews. The Final PEIS addresses the effects of climate change consistent with that guidance, including describing the sensitivity of resources to future impacts because of a changing climate. BOEM has prepared a new technical report (available at www.boem.gov) that quantifies the potential downstream greenhouse gas emissions and the social cost of carbon associated with ongoing OCS Program and 2017-2022 Program oil and gas activities and consumption of oil and gas produced on the OCS.

Comment ID	Commenter	Comment	Response
161	Lore Rosenthal, Greenbelt Climate Action Network	This PEIS is not properly looking at the climate change impact. According to your staff, you are not looking at what happens when the oil is burned, only when it is extracted. Once it arrives on shore, it becomes the problem of the USEPA. You know how much oil is in the ground, but cannot predict its end use. Therefore, you cannot completely predict how much CO_2 will be released. If it is extracted it will be used (burned). If it is used, it will release huge amount of carbon emissions. This will speed up the impact of climate change. It behooves the DOI and our President to cancel all oil drilling. The cumulative impact of all of these projects is immense.	The PEIS identifies and discusses the differences and challenges of spill response in the Alaskan environment in the Accidental Spills and Catastrophic Discharge Events Section, Chapter 4, dealing with ice, cold, and limited daylight conditions. Individual resources potentially impacted by a catastrophic discharge event (CDE), including those in Alaska, are discussed in the Potential Impacts per Resource Area Section, Chapter 4. This analysis of potential impacts is broad and considers entire planning areas. At subsequent lease sale stages, more specific information will be available regarding the location and level of activity, spill risk of proposed activities, and specific environmental resources in the area. At subsequent stages, BOEM might also conduct Oil Spill Risk Analysis modeling to better estimate spill risk, spill trajectories, and probability of contact with an environmental resource. Spill response methods and specifics would be analyzed in more detail in the individual lease sale stage environmental review documents as well as in spill response plans submitted as part of lessees' Exploration Plans and Development and Production Plans.
1	Lucia Simonelli	My comment is directed toward the fact that the PEIS seems to stress local and short-term impacts. The global and long-term environmental impact of these options presented and the alternatives discussed in Chapter 2 is not stressed, and the PEIS must seriously address these considerations for it to be truly comprehensive and unbiased.	The PEIS analyzes impacts for a 40-70 year window of oil and gas activity for each of the alternatives. Climate change is discussed in the Issues of Programmatic Concern Section of the PEIS; the analysis has expanded in the Final PEIS to include downstream consumption of oil and gas.
487	Martial Broussard	Please… respond to our concerns about abandoned leaking wells and pipelines. Industry must be required to pay and repair the damage caused by oil spills and petroleum drilling, production, and transport.	We recognize the concern with ongoing additions of oil into the environment. Potential cumulative impacts from the Proposed Action along with ongoing activities in each program area are reviewed at a programmatic level in Chapter 4. Chapter 3 identifies the Cumulative Activities Scenarios for each program area. Our sister agency BSEE (www.bsee.gov) is responsible for the safety and environmental enforcement associated with offshore oil and gas activities. BOEM will continue to actively engage with BSEE on developments and improvements in the exploration, production and development of these offshore resources.

Comment ID	Commenter	Comment	Response
33	Miyoko Sakashita	The PEIS can and should consider the climate change impacts associated with production and consumption of the oil reserves accessed under the Proposed Program.	On August 1, 2016, the Council on Environmental Quality issued Final Guidance for the Consideration of Greenhouse Gas Emissions and the Effects of Climate Change in National Environmental Policy Act Reviews. The Final PEIS quantifies downstream greenhouse gas emissions as a proxy for assessing climate change effects consistent with that guidance. BOEM has prepared a new technical report (available at www.boem.gov) that quantifies the potential downstream greenhouse gas emissions and the social cost of carbon associated with ongoing OCS Program and potential 2017-2022 Program oil and gas activities.
34	Miyoko Sakashita	The PEIS can and should consider an alternative that has no new leases.	The No Action Alternative considers no new leasing under the 2017-2022 Program. BOEM has reviewed the No Action Alternative assumptions and effects analyses and has ensured adequate consideration of the potential impacts. The document has been revised to include resource-specific discussions of the potential impacts of the No Action Alternative.
401	Margaret Williams, World Wildlife Fund	WWF believes that more complete analysis and inclusion of oil spill risk and response methods in the Final PEIS will counsel DOI to exclude the entire Arctic OCS Planning Areas from the 2017-2022 Leasing Program and use its authority to protect Arctic waters to the maximum extent possible.	The PEIS identifies and discusses the differences and challenges of spill response in the Alaskan environment in the Accidental Spills and Catastrophic Discharge Events Section, Chapter 4, dealing with ice, cold, and limited daylight conditions. Individual resources potentially impacted by a catastrophic discharge event (CDE), including those in Alaska, are discussed in the Potential Impacts per Resource Area Section, Chapter 4. This analysis of potential impacts is broad and considers entire planning areas. At subsequent lease sale stages, more specific information will be available regarding the location and level of activity, spill risk of proposed activities, and specific environmental resources in the area. At subsequent stages, BOEM might also conduct Oil Spill Risk Analysis modeling to better estimate spill risk, spill trajectories, and probability of contact with an environmental resource. Spill response methods and specifics would be analyzed in more detail in the individual lease sale stage environmental review documents as well as in spill response plans submitted as part of lessees' Exploration Plans and Development and Production Plans. The analyses provide information to the decisionmaker and no outcome is presumed.

Comment ID	Commenter	Comment	Response
402	Margaret Williams, World Wildlife Fund	WWF believes that more complete analysis and inclusion the protection of, the presence of, and acknowledging the values of unique sensitive marine and coastal areas in the Final PEIS will counsel DOI to exclude the entire Arctic OCS Planning Areas from the 2017-2022 Leasing Program and use its authority to protect Arctic waters to the maximum extent possible. The commenter then goes on to identify several 'environmentally important areas' and states that the Draft PEIS omits these places from its list of Environmentally Important Areas.	The Environmentally Important Areas considered in the PEIS represent regions of important environmental value where there is potential for conflict between ecologically important or sensitive habitats; maintenance of social, cultural, and economic resources; and possible oil and gas development. BOEM considered other areas, such as those provided in the commenter's letter, but did not carry them forward for full analysis. The dismissal justification for these areas may be found in Chapter 2 of the Final PEIS. There is nothing precluding these areas from being considered at the lease sale stage, if appropriate. The analyses in the PEIS provide information to the decisionmaker; the document does not presume any outcome.
403	Margaret Williams, World Wildlife Fund	If, however, Interior does proceed with Arctic OCS leasing, NEPA requires Interior to explain how it can do so while meeting the United States' stated goal to limit the nation's carbon emissions. Moreover, NEPA requires Interior disclose the cumulative and indirect effects of carbon emissions and analyze how Arctic OCS leasing can proceed despite the best current available science showing that a rational carbon budget cannot include production and combustion of oil from the Arctic. Interior must also explain how leasing is justifiable in light of the growing body of knowledge that increasing greenhouse gas emissions are contributing to ocean acidification, which adversely impacts the fundamental food chain in the Arctic Ocean. Should Interior decide to pursue leasing in Arctic OCS Planning Areas, it must more fully analyze and address the issues noted above as part of its decisionmaking so that the basis for its decisionmaking can be understood.	BOEM recognizes that the future may bring new legal, policy, technological, energy efficiency, or other market changes that could ultimately affect U.S. demand for and supply of oil and gas. The U.S. pledge, or Intended Nationally Determined Contributions (INDCs), is to reduce net (accounting for land use changes) greenhouse-gas emissions by 26-28% by 2025 (relative to 2005 levels). However, this U.S. INDC scenario does not assume “zero” oil and gas production or consumption in the future, but declining emissions from oil (and coal). The U.S. has made notable progress towards its 2025 emissions reduction target through measures identified in President Obama’s Climate Action Plan. BOEM continues to work within the organizing principal of OCSLA which directs, subject to environmental safeguards, the expeditious development of OCS oil and natural gas resources. BOEM's analysis is predicated on existing laws, regulations and policies and uses the authoritative estimates of future energy demand from the U.S. Department of Energy, Energy Information Administration (EIA) in its analysis. While the commenter does not specify an alternative method for forecasting future demand or supply of oil and gas, or other sources of energy, BOEM does not speculate over the infinite pathways that could lead to carbon targets. For example, BOEM does not incorporate the 2015 World Energy Outlook or Conference of the Parties 21 “New Policies,” “Bridge,” “INDC,” or “450” scenarios that reflect very different pathways to meet different carbon-reduction targets. The 2017-2022 Program only proposes a schedule of potential oil and gas lease sales consistent with the requirements of OCSLA; a given program decision does not make an irretrievable commitment to hold the sales and does not guarantee oil and gas production or downstream consumption. Because of the protracted time frame (approximately 70 years) under consideration, it is even possible that production may not occur or could be greatly reduced at some point in the future given new laws or policies, or technologies or energy efficiency improvements, or cost-competitive alternative sources of energy.

Comment ID	Commenter	Comment	Response
162	Mary Eargle	The Draft should, in my opinion, provide data that represents the correlation between climate change and offshore drilling. I believe offshore drilling's role in climate change should be included because climate change is one of the biggest issues mankind has ever faced.	On August 1, 2016, CEQ issued Final Guidance for the Consideration of Greenhouse Gas Emissions and the Effects of Climate Change in National Environmental Policy Act Reviews. The Final PEIS addresses the effects of climate change consistent with that guidance, including describing the sensitivity of resources to future impacts because of changing climate. BOEM has also quantified downstream greenhouse gas emissions as a proxy for assessing climate change effects.
404	Matthew Maiorana, Oil Change International	BOEM is dismissing the climate impact of drilling for fossil fuels that cannot be burned because its model assumes we will not act on climate and will accept a catastrophic level of climate change. This is not only self-defeating and dangerous but also ignores significant efforts to address climate change already under way [...] The U.S. government sorely needs to develop a starting point for climate analysis that begins with an assumption of climate success rather than failure.	BOEM recognizes the broad emissions reduction targets specified in the 2015 Paris Agreement and wholly understands that future climate policy measures may change the demand for and supply of fossil fuels. BOEM's analytical assumptions in the PEIS are consistent with authoritative projections from the U.S. Department of Energy, Energy Information Administration; those projections about future demand and supply are based on current laws and regulations. The 2017-2022 Program only proposes a schedule of potential oil and gas lease sales consistent with the requirements of OCSLA; a given program decision does not make an irretrievable commitment to hold the sales and does not guarantee oil and gas production or downstream consumption. Because of the protracted time frame (approximately 70 years) under consideration, it is even possible that production may not occur or could be greatly reduced at some point in the future given new laws or policies, or technologies or alternative sources of energy. The No Action Alternative broadly contemplates what would happen if there were no new OCS leasing and discusses a range of possible energy substitutes to meet future energy demand, including conservation and renewable energy. BOEM does not speculate how the Proposed Action or No Action Alternatives could be affected depending on how the U.S. achieves emission reduction targets.
72	Michelle Fasolino	Why isn't there anyone at the meetings to inform the citizens what the impact of drilling for more oil will have on our global climate change?	BOEM held 13 public meetings during the public comment period on the Draft PEIS. Staff were present to answer questions from the public and BOEM made an effort to address all concerns raised during these meetings. As a result of questions that arose during the meetings and multiple comments from the public, BOEM has expanded the climate change analysis to include downstream consumption of oil and gas.

Comment ID	Commenter	Comment	Response
73	Michelle Fasolino	Why isn't this meeting also be held other places on the Gulf Coast so people can attend that can't travel here?	Public meetings for the Draft PEIS were held in two locations along the Gulf coast - New Orleans, Louisiana, and Houston, Texas. Given the proposed leasing within the Western and Central Gulf of Mexico Planning Areas, BOEM determined that adequate geographic coverage of potentially affected coastal communities of the Texas, Louisiana, Alabama, and Mississippi coasts would be realized with two meetings in these locations. In addition, the Draft PEIS document was made available for review on the BOEM website; comments on the Draft document could also be submitted either in person or electronically at the public meetings, via mail, or to regulations.gov website during the 45-day comment period. Online access to the document and comment submittal opportunities either in person, online or via mail provided several mechanisms for public comment.
437	Mitchell Wenkus	BOEM should use the government's social cost of carbon indicator when factoring in the cost of each well.	On August 1, 2016, the Council on Environmental Quality issued Final Guidance for the Consideration of Greenhouse Gas Emissions and the Effects of Climate Change in National Environmental Policy Act Reviews. The Final PEIS addresses the effects of climate change consistent with that guidance, including describing the sensitivity of resources to future impacts because of a changing climate. BOEM has also quantified downstream greenhouse gas emissions as a proxy for assessing climate change effects. CEQ regulations or the new guidance from CEQ do not expressly require the monetization of cost and benefits. BOEM has estimated the social cost of carbon in a separate technical report (available at www.boem.gov), and then summarized and referenced that broader analysis, as appropriate, in the PEIS or other Program documents.
433	Monty Rogers, Cultural Alaska	I am providing comment to voice my concerns on the narrow focus of cultural resources considered in the Beaufort and Chukchi Program Areas by the Bureau of Ocean Energy Management (BOEM) in their 2017-2022 Outer Continental Shelf Oil and Gas Leasing Program 2017-2022 Draft Programmatic Environmental Impact Statement. Cultural resources include more than archaeological sites, old buildings, and shipwrecks. The commenter also included several references for review and inclusion in the PEIS. [(Ball et al. 2015:28), (King 2000)] Another concern is the lack of consideration of BOEM's own 2015 study "A Guidance Document for Characterizing Tribal Cultural Landscapes" (Ball et al. 2015) in this Draft PEIS.	Text has been revised in the Final PEIS to address concern.

Comment ID	Commenter	Comment	Response
222	Mr. Soren Wuerth, Alaska Wilderness League	So I talked to some of people inside at the meeting, and one of the points that I really want to amplify is this idea of cumulative impacts. So the proposed drilling plans, under this federal agency, does not include the existing impacts on the oceans; for example, like plastics, that are swirling in the ocean in huge gyres, that encompass thousands of square miles. This damage to the ocean is adding ocean acidification. And on top of the noise in the ocean and on top of the impacts from climate change -- all of these collected impacts are hard enough to address now we have an agency that is just thinking about adding more pollution to an already threatened ecosystem, one that we depend on, not just for food but for potentially its -- its connection with the Earth, environment climate systems, because the ocean is a big driver of the climate.	Chapter 3 and Appendix B in the PEIS identify the cumulative actions that could affect the present and future condition of ocean resources. Cumulative actions are discussed at a broad, programmatic level for each resource area in Chapter 4. The Final PEIS has been revised to more clearly identify the incremental contribution from the Proposed Action towards cumulative effects.
223	Mr. Tom Lakosh, Alaska Wilderness League	It is my hope that BOEM will properly consider the adverse impacts, under the Endangered Species Act, for oil exploration and production activities in the Outer Continental Shelf, particularly in areas where there may be surface freezing that will impair the ability to properly protect critical habitat from encroachment of oil, that will produce unlawful taking of protected species under the Endangered Species Act even if there were full compliance with OPA 90, under 30 CFR Section 254. And that, in fact, it is impossible to meet the mandates of OPA 90 to provide for effective and immediate removal [of] oil once spilled, given the state of the art of technology.	BOEM has considered impacts on ESA listed species in the PEIS; however, Section 7 Consultation is not conducted at the Five Year PEIS stage. At this programmatic stage, BOEM is only identifying where possible leasing could occur across all the program areas over the next five year period (2017-2022). No ground disturbance is occurring at this point. Should leasing occur in any of the areas, BOEM will conduct ESA Section 7 Consultation with both the National Marine Fisheries Service and the U.S. Fish and Wildlife Service that is site-specific to a leased area that will address the possible actions stemming from lease issuance, such as exploration, development, and production. In all of BOEM's planning areas, including the Arctic, BOEM considers potential impacts on both protected species and critical habitat that are site-specific to the action proposed. Note, however, that at this programmatic stage and analysis, BOEM does consider impacts broadly from this Proposed Action to protected species.

Comment ID	Commenter	Comment	Response
224	Mr. Tom Lakosh, Alaska Wilderness League	In the PEIS process, BOEM must dismiss the notion that the probability of spills is low enough to allow the use of technology that is incapable of preventing encroachment of oil in critical habitats, and that it must assume, as does OPA 90, that there is a probability of oil spills, that is unacceptable, and that must at all times be assumed to happen, and therefore, provide for effective containment and recovery of oil, with technology capable of doing so.	The PEIS identifies and discusses the differences and challenges of spill response in the Alaskan environment in the Accidental Spills and Catastrophic Discharge Events Section, Chapter 4, dealing with ice, cold, and limited daylight conditions. Individual resources potentially impacted by a catastrophic discharge event (CDE), including those in Alaska, are discussed in the Potential Impacts per Resource Area Section, Chapter 4. This analysis of potential impacts is broad and considers entire planning areas. At subsequent lease sale stages, more specific information will be available regarding the location and level of activity, spill risk of proposed activities, and specific environmental resources in the area. At subsequent stages, BOEM might also conduct Oil Spill Risk Analysis modeling to better estimate spill risk, spill trajectories, and probability of contact with an environmental resource. Spill response methods and specifics would be analyzed in more detail in the individual lease sale stage environmental review documents as well as in spill response plans submitted as part of lessees' Exploration Plans and Development and Production Plans. In addition, the lessee is required to submit an oil spill response plan to BSEE (www.bsee.gov) prior to drilling activates and prove that they have financial funds to address spills, if they were to occur (OPA90).

Comment ID	Commenter	Comment	Response
210	Ms. Epstein, Alaska Wilderness League	There is no proven technology to recover significant amounts of spilled oil from icy, stormy seas. A major oil spill could devastate the marine environment and sensitive coastal areas, including portions of the Arctic National Wildlife Refuge and the National Petroleum Reserve Alaska. Note that there is no 25-mile coastal withdrawal area from leasing in the Beaufort Sea as there is in the Chukchi Sea. Moreover, Congress and federal regulators have not made several essential changes to prevent deaths and major spills as recommended by expert committees established after the BP Deepwater Horizon tragedy. Those recommendations include increasing liability limits substantially from $75 million and protecting whistleblowers. Arctic-specific exploration and production regulatory requirements have not been finalized. Ms. Rabeau/Ms. Olsen/Ms. Gemmill: If there were a spill, none of the primary oil-spill responsive methods mechanical containment and recovery, burning or disbursements have proven effective in Arctic conditions. Mr. Moderow: We know that this development can't be done safely, not with today's technology. Even the government knows that an oil spill is likely if offshore drilling proceeds. For existing leases, the government's own PEIS predicts a 75 percent likelihood of a large oil spill in the Chukchi, if even just the current Chukchi leases start producing oil. Mr. Blake: The people buying these leases should have to prove that spills can be cleaned up before they even ever have an option to lease in the Arctic.	Challenges and limitations of oil spill response in the Arctic are discussed in the Accidental Spills and Catastrophic Discharge Events Section of the PEIS. This includes difficulties from remote access, lack of infrastructure, shallow water limitations, and icy conditions resulting in greater impacts from a potential accidental spill or catastrophic discharge event in the Arctic. In addition, this section cites the recent NRC report documenting issues and concerns with exploration in the Arctic (NRC 2014). Overall impacts were determined to range from minor to major depending on the location, timing, and magnitude of the event, as well as the effectiveness of the containment and cleanup activities. If a decision is made to move forward with any of the lease sales in the Proposed Five Year Program, additional reviews will take place that will be more site-specific and will analyze impacts and response concerns in greater detail. Subsequent incremental NEPA documents will be written at the individual lease sale level and within these analyses the issues raised here with lack of infrastructure, technology and response methods will be addressed in more detail. The lessees are required to demonstrate their ability to respond to a spill during the leasing process. BOEM recognizes the commenters' concern with potential oil spill impacts and liability. BSEE (www.bsee.gov) is responsible for the safety and environmental enforcement associated with offshore oil and gas activities. BOEM will continue to actively engage with BSEE on developments and improvements in the exploration, production and development of these offshore resources.
220	Ms. Faith Gemmill, Alaska Wilderness League	We're also concerned about the Arctic National Wildlife Refuge coastline, which will be impacted, as well.	The Arctic National Wildlife Refuge (Arctic NWR) is considered a Marine Protected Area as defined by Executive Order (EO) 13158. In this PEIS, BOEM analyzed the potential impacts to the species and habitats that occur across the North Slope of Alaska, including those that occur in the Arctic NWR. This fulfills BOEM's requirement under EO 13158 that each "federal agency whose actions affect the natural or cultural resources that are protected by an MPA shall identify such actions." Should a lease sale occur in the Beaufort Sea, site specific environmental analyses will be done that will, if applicable, more fully analyze the potential impacts to the Arctic NWR as required by EO 13158.

Comment ID	Commenter	Comment	Response
215	Ms. Julie Rabeau, Alaska Wilderness League	If there were a spill, none of the primary oil-spill responsive methods -- mechanical containment and recovery, burning or disbursements-- have proven effective in Arctic conditions.	The PEIS identifies and discusses the differences and challenges of spill response in the Alaskan environment in the Accidental Spills and Catastrophic Discharge Events Section, Chapter 4, dealing with ice, cold, and limited daylight conditions. Individual resources potentially impacted by a catastrophic discharge event (CDE), including those in Alaska, are discussed in the Potential Impacts per Resource Area Section, Chapter 4. This analysis of potential impacts is broad and considers entire planning areas. At subsequent lease sale stages, more specific information will be available regarding the location and level of activity, spill risk of proposed activities, and specific environmental resources in the area. At subsequent stages, BOEM might also conduct Oil Spill Risk Analysis modeling to better estimate spill risk, spill trajectories, and probability of contact with an environmental resource. Spill response methods and specifics would be analyzed in more detail in the individual lease sale stage environmental review documents as well as in spill response plans submitted as part of lessees' Exploration Plans and Development and Production Plans.
213	Ms. Karen Barnard, Alaska Wilderness League	I am very, very concerned about spills in the Arctic. Now, we've shown that -- or, the oil companies have shown, with the Gulf of Mexico and the Prince William Sound spills--that we cannot clean these up. We have a cold-water spill; ten, twenty years, thirty years later, it's still there. Now we have a warm-water spill; it's still a mess down there. We are insane if we believe that we can drill safely in the Chukchi. All that oil gets encapsulated in ice; it's unreachable. So there's some serious logic problems if people are thinking it's safe to drill in cold ice-laden waters.	The PEIS identifies and discusses the differences and challenges of spill response in the Alaskan environment in the Accidental Spills and Catastrophic Discharge Events Section, Chapter 4, dealing with ice, cold, and limited daylight conditions. Individual resources potentially impacted by a catastrophic discharge event (CDE), including those in Alaska, are discussed in the Potential Impacts per Resource Area Section, Chapter 4. This analysis of potential impacts is broad and considers entire planning areas. At subsequent lease sale stages, more specific information will be available regarding the location and level of activity, spill risk of proposed activities, and specific environmental resources in the area. At subsequent stages, BOEM might also conduct Oil Spill Risk Analysis modeling to better estimate spill risk, spill trajectories, and probability of contact with an environmental resource. Spill response methods and specifics would be analyzed in more detail in the individual lease sale stage environmental review documents as well as in spill response plans submitted as part of lessees' Exploration Plans and Development and Production Plans.

Comment ID	Commenter	Comment	Response
219	Ms. Kory Blake, Alaska Wilderness League	I've been a commercial fisherman for 46 years, three generations in Alaska. They said they could clean up the oil [from the Exxon Valdez], they said they could protect us and our fisheries, yet we still have fisheries today that have not come back to Prince William Sound. I've been on the SERVS, Alyeska SERVS corp fleet, as oil response, and no matter what these people think here, they do not have the equipment to clean up any volume spill, even today. They might be better at it, but they would not be able to contain it. [The government should make companies] prove that they can do it [clean up oil] before they even ever have an option to lease in these areas.	The PEIS identifies and discusses the differences and challenges of spill response in the Alaskan environment in the Accidental Spills and Catastrophic Discharge Events Section, Chapter 4, dealing with ice, cold, and limited daylight conditions. Individual resources potentially impacted by a catastrophic discharge event (CDE), including those in Alaska, are discussed in the Potential Impacts per Resource Area Section, Chapter 4. This analysis of potential impacts is broad and considers entire planning areas. At subsequent lease sale stages, more specific information will be available regarding the location and level of activity, spill risk of proposed activities, and specific environmental resources in the area. At subsequent stages, BOEM might also conduct Oil Spill Risk Analysis modeling to better estimate spill risk, spill trajectories, and probability of contact with an environmental resource. Spill response methods and specifics would be analyzed in more detail in the individual lease sale stage environmental review documents as well as in spill response plans submitted as part of lessees' Exploration Plans and Development and Production Plans. In addition, the lessee is required to submit an oil spill response plan to BSEE (www.bsee.gov) prior to drilling activates and prove that they have financial funds to address spills, if they were to occur (OPA90).
75	Nils Andreassen, Institute of the North	The PEIS should carefully consider both the socioeconomic benefits and challenges of energy development in the Arctic. The Institute of the North organized a study of five remote Arctic communities to better understand the socioeconomic benefits and challenges of energy development in the Arctic. We believe the case study of Hammerfest, Norway is particularly instructive to Arctic OCS development in that it demonstrates the potential for improving the quality of life that can occur with offshore development of oil and gas resources. Much of the economic and social outcomes are related to grid connectivity.	The information provided in the Hammerfest, Norway, case study is consistent with BOEM's analyses of the potential impacts of the Proposed Action in the Beaufort and Chukchi Seas Program Areas found in the Population, Employment and Income Section, Chapter 4. Employment and income from new oil and gas activity would provide economic opportunity for existing, and potentially new, workers in local areas. Major increases in activity--especially if they occur rapidly--could impose strains on public infrastructure in some communities.
490	Ninilchik Meeting Transcribed Notes	Larval fish are captured in eddies in Kachemak Bay and may be disproportionately affected by activities due to their longer term entrainment in this area.	BOEM recognizes the importance of site-specific analysis of potential impacts on key species, however further analysis that may include impacts to various lifestages of fishes is more appropriate at the lease sale stage.
491	Ninilchik Meeting Transcribed Notes	Reference to de-listed ringed seals in Appendix C needs to be updated.	New text has been added to address the comment.

Comment ID	Commenter	Comment	Response
492	Ninilchik Meeting Transcribed Notes	It's not feasible to use existing infrastructure for new federal leases in Cook Inlet.	BOEM finds that the existing onshore infrastructure in Cook Inlet being utilized by the oil and gas industry in Alaska state waters could be sufficient to support new exploration and development in Federal waters in Cook Inlet. Once the potential new development in Federal waters is brought to production, BOEM anticipates that a pipeline could need to be constructed to support this new production (see Exploration and Development Scenarios, Chapter 3). Those impacts will be addressed more thoroughly in activity-specific NEPA documents.
459	NOAA Fisheries	Page xi, lines 40-41 (Draft PEIS): The document states that the analyses consider the effects of a catastrophic discharge event, even though the occurrence of such a spill is unexpected. Given the fact that there have been 4 documented spills like this (pages 3-26), most recently the Deepwater Horizon oil spill, BOEM needs to acknowledge the real-time likelihood of a catastrophic discharge event and not dismiss it is as being "unexpected."	The term "unexpected" is used to describe the relatively low likelihood of a very large oil spill. Statistical analysis of historical data indicate that such oil spills are not expected to occur with regular or predictable frequency. Moreover, regulatory reforms have been put into place to reduce the likelihood of spills and require containment and response capabilities that, if effective, would reduce the overall volume of oil released into the marine environment. Chapter 3 of the PEIS provides the statistical basis to support its assertion regarding the relatively low likelihood of a CDE. Despite that low probability of occurrence, the PEIS acknowledges a CDE is possible and provides the analysis of the catastrophic consequences if such an event were not occur.
460	NOAA Fisheries	Pages 3-26, 3-27 (Draft PEIS): As previously discussed through consultation with NOAA Fisheries on the Biological Opinion for Oil and Gas Development in the Gulf of Mexico, an analysis that describes the chances of another catastrophic oil spill, similar to Deepwater Horizon, as not returning for 451 years is improper and not reflective of the actual occurrence of such spills. The analysis provided by BOEM, despite relying on peer reviewed literature, is not reflective of the current situation of oil spills of this magnitude, and inappropriately diminishes the possibility of such a catastrophic discharge event even occurring. It is recommended that BOEM describe how the analysis technique was peer reviewed for decisionmakers and the public to understand the rigor of the process used. It is also recommended that BOEM describe how their regulations and oversight of actions will reduce, at any level, the chances for a catastrophic discharge event.	The analyses that contributed to these statements were provided within the PEIS in the Exploration and Development Scenarios and Accidental Events Sections, Chapter 3. In addition, further details about these analyses are available through published literature cited in the PEIS, specifically Anderson et al. 2012, Ji et al. 2014, and Bercha Group 2014. BOEM's sister agency BSEE is responsible for the environmental oversight and enforcement with regard to reduction of catastrophic events. Please visit BSEE.gov for additional information regarding BSEE programs.

Comment ID	Commenter	Comment	Response
462	NOAA Fisheries	Page 3-29, Section 3-5 Impact Producing Factors (Draft PEIS): This section should also discuss how a catastrophic discharge event will affect each impact producing factor, as well as a complete effects analysis of such an event for each of the three proposed alternatives.	Potential impacts from accidental spills and catastrophic discharge events as a result of the Proposed Action are evaluated and discussed in Chapter 4. Evaluations included consideration of fate and transport of oil, region-specific physical and environmental factors, and potential impacts for each evaluated resource. Potential impacts from accidental spills and unexpected catastrophic discharge events (CDE) for each resource were given a rating ranging from negligible to major based on the evaluation. The Deepwater Horizon event is considered a CDE and CDE impacts have been evaluated in the PEIS. The PEIS considers impacts on each of the identified 17 resources from the IPF activities in addition to a catastrophic discharge event.
463	NOAA Fisheries	Page 3-41 (Draft PEIS): The description of cumulative effects is appreciated; however, this section should analyze the effects of the entire leasing period, and the estimated life of projects for each geographic region, as opposed to just describing them.	Chapter 3 and Appendix B in the PEIS describe the cumulative actions considered in the cumulative effects analysis. The actual analysis of cumulative effects is provided in Chapter 4. The cumulative effects analysis in Chapter 4 has also been revised to provide additional information for each resource area to support conclusions regarding the incremental contribution to cumulative effects.
464	NOAA Fisheries	Page 4-18, Lines 15-16 (Draft PEIS): Given BOEM's experience with understanding the effects of oil and gas leasing on marine mammals, it seems unreasonable to state that "Fully predicting impacts from marine sound and the degree of any effect is impossible at the programmatic scale being considered under the Proposed Action." BOEM may be able to refer to analyses that they have performed over the past 10 years to provide a reasonable analysis of effects to marine mammals from marine sound.	BOEM has played a key role in improving the scientific understanding of noise and marine life to date (see http://www.boem.gov/Fact-Sheet-on-Sound-Studies/) and remains steadfastly committed to funding and supporting science needed to better understand anthropogenic sounds and their impacts on marine life. BOEM also is dedicated to using adaptive management for this complicated issue so that approaches evolve as understanding expands and the science matures. The PEIS describes the pathways through which impacts from noise to marine mammals could occur and provides a high-level analysis of these impacts consistent with a programmatic approach. Subsequent approvals of more site- or region-specific analyses that may result from implementation of the Proposed Action consider the most recent science available at the time of the decision as well as additional mitigation measures (and their efficacy) to limit the potential for masking or behavioral disruption (e.g., time-area closures, limiting activities in space and time).

Comment ID	Commenter	Comment	Response
465	NOAA Fisheries	The PEIS should describe and analyze onshore/nearshore oil and gas transport and infrastructure construction and operation in more detail to determine how coastal, estuarine, and riverine species and habitats under NMFS jurisdiction may be affected by the Proposed Program. The Draft PEIS mentions in several places that installation and operation of onshore pipelines and support facilities may result in "Impact Producing Factors" (IPF) such as noise, bottom/land disturbance and increased vessel traffic (Section 1.4.2, p.1-4; Section 3.1.1.5, p.3.4; and Tables 3.5-1 & 3.5-2). However, there is no discussion of how these factors might impact nearshore ESA listed species such as Gulf sturgeon and their designated critical habitats. In fact, Section 4.4.1.9 on p. 4-95 states that the only IPF with the potential for moderate impacts to fish and EFH are oil spills.	The explanation of IPFs is included in Appendix E, but since noise, bottom/land disturbance and increased vessel traffic IPFs were classified as minor to negligible, they were not described in detail in the PEIS. Impacts expected to be negligible to minor are identified in Appendix E but not discussed in the main chapters of the PEIS; only moderate or major impacts are included in Chapter 4. In the analysis of IPFs, all federally managed and protected species in each region were considered, including Gulf sturgeon (see Fish and EFH Affected Environment Section). Additional consultation with NMFS occurs at subsequent environmental review stages.
466	NOAA Fisheries	Page 4-88 (Draft PEIS) includes a description of potential impacts to corals such as direct contact with equipment and anchors/chains, discharges during drilling and production operations, and smothering of benthic organisms due to drilling-related sediment movement. However, we could not find any mention of ESA listed corals anywhere in the document. The document (or appendices) should describe all ESA listed corals that may be present in the program area and specifically analyze how program activities may affect those listed coral species.	ESA listed coral species are listed and discussed in Chapter 4, Affected Environment, Marine Benthic Communities Section. Potential impacts to marine benthic communities are discussed in Chapter 4.
468	NOAA Fisheries	BOEM should update the PEIS to include biologically important areas (BIAs) for Alaska (Clarke et al. 2015, Ferguson et al. 2015). Exclusions of all environmentally important areas (EIAs) combined with seasonal restrictions on other impact producing activities permitted by BOEM (e.g., seismic exploration surveys) would provide the highest level of protection for all marine mammal species in the program areas. This would result in no exploration or development taking place within the designated EIAs.	BOEM has updated the document with reference to BIAs offshore Alaska. The PEIS analyzes mitigation measures up to and including exclusions of EIAs to reduce impacts. This information will be used to inform future decisions. The analyses provide information to the decisionmaker and no outcome is presumed. Pre-lease seismic exploration surveys are not within the scope of this PEIS.

Comment ID	Commenter	Comment	Response
469	NOAA Fisheries	The PEIS should discuss how the Oil and Gas Leasing Activities and potential aquaculture activities will affect each other, and whether there is a process designed to address potential future conflicts. In January 2016, NMFS published final regulations implementing the Gulf of Mexico Fishery Management Council's Fishery Management Plan for Regulating Offshore Marine Aquaculture in the Gulf of Mexico. The regulations specify that NMFS will consult with BOEM, Bureau of Safety and Environmental Enforcement, and other Federal agencies, as appropriate, to address and resolve any conflicts in use of the OCS, with special emphasis on OCS energy programs for resolving and documenting the proposed solution of existing conflicts. NMFS also continues to work with BOEM through the Interagency Working Group on Aquaculture's Regulatory Task Force to identify such potential OCS during the permitting and review process for aquaculture permits in federal waters of the Gulf of Mexico.	NOAA's Aquaculture Management Plan creates a permitting process to understand the potential conflicts with other industries including oil and gas development on the OCS. The Aquaculture Management Plan further identifies potential conflicts. Impacts on aquaculture are more appropriate for a spatial conflict analysis at the lease sale stage. Aquaculture environmental impacts are addressed through a number of assessments including the National Environmental Policy Act and through development of Biological Opinions. http://gulfcouncil.org/Beta/GMFMCWeb/ Aquaculture/Aquaculture%20FMP%20PEIS%20Final%202-24-09.pdf
471	NOAA Fisheries	Ideally, further analysis should be tailored to the specific geographies that the PEIS covers (e.g., Atlantic, Gulf of Mexico, Alaska, Arctic), because the chance of catastrophic discharge event, the environmental effects from such an event, and the response to it will vary greatly by geographic region. BOEM has widely reported advances in prevention and response to oil spills have been made since the last catastrophic oil spill in the Gulf of Mexico. The potential for similar events in each area, and measures to prevent and respond to these potential occurrences should be more thoroughly discussed. BOEM needs to describe their regulatory and oversight role in detail, because it is this information that is critical to preventing a catastrophic discharge event from happening, or stopping one if it does occur.	Impacts of oils spills are discussed generally for the regions included in the Accidental Spills and Catastrophic Discharge Events Section (Chapter 4) and more specifically for each resource in Potential Impacts per Resource Area Section (Chapter 4). Additionally, each resource discusses and gives the rating for spill impacts of accidental spills and a catastrophic discharge event (CDE) within the Potential Impacts per Resource Area Section. If the program area has a lease sale, more detailed consideration of potential CDE impacts will be included in the lease sale environmental review. Spill response is discussed in Appendix I, Mitigation and Protective Measures, but the broad scope of the PEIS is not specific to the types of technologies and methods involved in spill containment. Spill response methods and specifics would be analyzed in individual lease sale stage environmental review documents as well as in spill response plans prepared by lessees. In addition, BOEM's responsibilities are outlined in Chapter 1, Key Agency Responsibilities.
476	NOAA Fisheries	As BOEM develops the PEIS for the Proposed Program, consultation with NMFS may be required. The regional fishery management councils established by the Magnuson-Stevens Act also may provide EFH recommendations for OCS activities.	BOEM does not conduct, nor does NMFS ask for EFH consultation, at the Five Year PEIS stage. At this stage, BOEM is only identifying where possible leasing could occur over the next five year period (2017-2022). Impacts on EFH are considered at the broad, programmatic level at this stage. Should leasing occur in any of the areas identified at this programmatic stage over the next five years (2017-2022), BOEM will determine whether EFH consultation is required, as per the Magnuson-Stevens Fishery Conservation and Management Act.

Comment ID	Commenter	Comment	Response
479	NOAA Fisheries	Section 4.2.2 (Draft PEIS) provides discussion of program-related acoustic effects on marine resources. Some of the activities described as potentially causing acoustic impacts include geophysical surveys, ship and aircraft traffic, drilling and production operations, trenching, and construction (and removal) of structures and facilities. However, the bulk of the analysis centers on effects from geophysical surveys and the use of explosives in deconstruction of facilities. There is very little discussion/analysis of acoustic impacts related to pile driving associated with facility construction. Pile driving is a major noise producing activity in the marine environment that may affect fish, sea turtles, and marine mammals. Table 3.5-2 on p. 3-30 states that program related pile driving would generate a sound source level of 228 dB re 1 μPa-m with a broadband frequency range. This is a very high decibel level which could cause direct physical injury to listed fish, sea turtles and marine mammals in the immediate vicinity of the pile driving activities. The document should include a detailed description of potential program related pile driving activities and a comprehensive analysis of the effects of these activities on protected species and other marine resources. For details on NMFS approved methodologies for quantifying impacts to listed species from pile driving activities contact Mike Tucker [comment provides contact information].	The level of analysis in the PEIS is in compliance with recent CEQ guidance on programmatic reviews (CEQ 2014) and is an appropriate level of detail for the decision at hand. The analysis is at a national level, and the scope of impacts is described broadly, providing geographic specificity as appropriate. If a decision is made to move forward with any of the proposed lease sales in the Proposed Five Year Program, additional reviews will take place that will be more site-specific and will analyze impacts, including those from pile driving if appropriate, in greater detail. Subsequent incremental NEPA documents will be written at the individual lease sale level.

Comment ID	Commenter	Comment	Response
481	NOAA Fisheries	Alternative B should include the Chukchi corridor expansion NMFS requested in our March 2015 Draft Five Year plan comments. This proposed expansion out to approximately 60 miles from shore could affect the size or location of potential leasing and overlaps with five lease blocks. NMFS recommends adding the Chukchi Sea corridor expansion as part of the EIAs described under Alternative B(2)(b). NMFS suggests extending the current 25-mile buffer out to 60 miles from shore in the Chukchi Sea. This extended area would encompass part of the proposed Walrus Movement Corridor EIA in addition to bowhead whale, gray whale, beluga whale, ringed seal and bearded seal EIAs. Alternative B(2)(b) should not only consider the exclusion of this area, but also include temporal closures (from the time ice moves off the shelf through October). Exclusions apply toward all activities discussed as part of or resulting from the Proposed Action. The temporal closures apply specifically to geophysical exploration and exploratory drilling activities. Programmatic mitigation for this area may provide an additional buffer from potential oil and gas related spills, but would not protect against spills from other sources (e.g., barge traffic, shipping, tourism cruises).	BOEM has evaluated the recommendation to expand the Chukchi Corridor evaluated in the PEIS out to 60 miles rather than 50 miles and to exclude this area from leasing. It is appropriate to consider a 50-mile (Presidential Withdrawal area, plus 25 miles) corridor at the Five Year stage. This is a compromise amongst the scoping comment suggestions and should provide a reasonable approach to analyzing the efficacy of a corridor. Fifty miles also encompasses the majority of important habitat areas, including the spring lead system. The analysis suggests that a time-area closure or activity restrictions during certain times of the year would reduce impacts to species of concern in this area, such as bowhead and gray whales, seals, seabirds and sea ducks. Consideration of 60 miles as an exclusion could take place at subsequent phases of analysis, such as during the preparation of a lease sale PEIS.
482	NOAA Fisheries	NMFS supports the exclusion of Cook Inlet beluga whale critical habitat from the Cook Inlet Program Area. Alternatively, the program area should include temporal closures (October through start of May). Exclusions apply toward all activities discussed as part of or resulting from the Proposed Action. The temporal closures apply specifically to geophysical exploration and exploratory drilling activities.	BOEM has evaluated the recommendation to employ temporal closures for certain activities in the Cook Inlet Program Area to limit impacts on beluga whales. BOEM recognizes the potential for impact to this population and has analyzed in the PEIS an alternative that would exclude areas of critical habitat from consideration for leasing in order to address this. Temporal closures could be analyzed at subsequent NEPA stages if appropriate.

Comment ID	Commenter	Comment	Response
483	NOAA Fisheries	NMFS reiterates the need for both area and seasonal/temporal exclusion or closures. If BOEM proceeds with only EIA area exclusions, exploration and development activities could still occur within these areas on active leases from previous lease sales. Ship and aircraft traffic could still transit within excluded areas. In addition, seismic research could still occur within EIAs as well as ancillary activities within existing leases. However, these environmental impacts could be avoided through area and seasonal/temporal exclusions. Seasonal/temporal exclusion would prevent stressors from occurring during critical time periods such as bowhead spring migration or summer feeding. We recommend including BIA information (e.g., Kaktovik is not only important for hunting and bowhead migration, but also bowhead feeding) (Clarke et al. 2015, Ferguson et al. 2015).	BOEM has revised the document to include reference to the BIAs in waters offshore Alaska. The PEIS analyzes mitigation measures up to and including exclusions of EIAs to reduce or avoid impacts. This information will be used to inform future decisions. The PEIS provides information on how certain mitigation measures could reduce impacts on certain resources; however, specific mitigation measures and the way in which they could be implemented is generally decided at the lease sale phase. The scope of the PEIS includes leasing activities that occur during the 2017-2022 Oil and Gas Program; this document is not used to inform decisions related to existing leases or the activities that take place on them. BOEM does not have jurisdiction to restrict vessel or aircraft traffic within the EIAs if an exclusion were selected.
484	NOAA Fisheries	Section 4.4.5.4 Biologically Important Areas (Draft PEIS): This section should include BIAs for Alaska species as well as those for the Atlantic coast. The following Alaska-focused sections concern the Chukchi and Beaufort Seas, and Cook Inlet, identify BIAs, and provide scientific references for the exclusion of key areas concentrated within the proposed extended Chukchi buffer and Beaufort areas of concern.	BOEM has included information on Biologically Important Areas for the Arctic Program Areas in Appendix C. In addition, BOEM has cited BIAs for the Arctic Program Areas (Clarke et al. 2015) as support for the identification of Environmentally Important Areas.

Comment ID	Commenter	Comment	Response
495	Nuiqsut Meeting Notes Transcribed	Zero tolerance on discharge should be part of BOEM's regulations. There should be no drilling waste; it should all be hauled away. This Five Year document does not include this. CAA is a requirement of MMPA. The regulatory enforcement isn't in place to do development.	The issue of regulatory and safety procedures is briefly discussed in several sections of the PEIS to provide a broad overview within a programmatic context (see Section 1.3, Appendix I and Appendix J). It is noteworthy that the PEIS, as a programmatic document, provides a broad analysis of the projected levels of exploration, development, production, and decommissioning activities which result from leasing during the 2017-2022 period. Further, more detailed analysis of site-specific issues and impacts, including permitted discharges, will be conducted in future lease sale EISs and specific project plans. Discharges from OCS facilities must comply with regional NPDES permit limitations; discussion and analysis of existing regulations and the possible need for more stringent discharge limits would be considered at the lease sale and/or project-specific plan stage. No revisions to the PEIS are required. The following link provides additional detail on regulatory and safety reform undertaken by BOEM and BSEE as well: http://www.bsee.gov/BSEE-Newsroom/Press-Releases/2016/Interior-Department-Releases-Final-Well-Control-Regulations-to-Ensure-Safe-and-Responsible-Offshore-Oil-and-Gas-Development/ The Conflict Avoidance Agreement process is administered by the National Marine Fisheries Service to mitigate impacts to subsistence resources as required under the Marine Mammal Protection Act; requirements for discharges as a part of the CAA process are outside BOEM's jurisdiction. This Final PEIS analyzes requirement of a Conflict Management Plan for the Alaska program areas that would facilitate coordination and communication between local communities and OCS oil and gas activities.
493	Nuiqsut Meeting Transcription	Pt. Barrow to Pt. Hope needs a 25 mile buffer zone. Deferral line should be deleted since Shell pulled out. Harrison Bay [temporal closure] should be June-September. Most active areas for oil and gas.	There is a 25-mile Presidential Withdrawal along the Chukchi Sea coast, including the area from Barrow to Point Hope. This area can no longer be considered for leasing under any Program, absent executive action. BOEM analyzed seasonal activity restrictions from June through August because that time period is representative of the highest densities of birds in Harrison Bay; however, this timeframe could be re-visited at subsequent decision phases. Buffers around existing leases are outside of the scope of this PEIS.

Comment ID	Commenter	Comment	Response
494	Nuiqsut Meeting Transcription	Need full consultation with whalers so whalers can help with mitigation. They have knowledge and know the conditions. Cross Island, used to hunt out of Thetis; but the hunt was impacted by activity. Hold the industry to CAAs; we have to travel 90 miles just to get to our hunting grounds. It is not easy to watch a whale. CAAs must include drilling muds. Alt B(1)(b) is what BOEM wants. Unlikely that BOEM will choose "No Action". This is the point where BOEM should be consulting with the whalers. BOEM needs to come back many times to consult with the community. CAAs should be used as a tool. BOEM should adopt this same process, for the Five Year and lease sales.	BOEM acknowledges existing measures to deconflict use of the Arctic OCS and appreciates the long history of coordination that has gone into making these efforts successful. In the Final PEIS, BOEM included how development of an Alaska Conflict Management Plan as a condition of plan approval could mitigate impacts. The planning and analysis process undertaken every five years provides information to the decisionmaker; no outcome is presumed. However, should leasing move forward in the Arctic, coordination and consultation with local communities will continue throughout the leasing process.
496	Nuiqsut Meeting Transcription	Need to come up with more ideas for mitigating/avoiding impacts for whaling. All the royalties go to industry/feds. What about us?	Changing the distribution of royalties from offshore oil and gas industry activities is beyond the purview of BOEM and would require action at the legislative and/or Secretarial level.
497	Nuiqsut Meeting Transcription	Social impacts of an oil spill-you're going to take our food. The National Petroleum Reserve in Alaska has Health Impact Assessment; we need that for the OCS. We need to be preventative/protective of human health.	Under alternatives where no leasing would occur (No Action Alternative, Reduced Proposed Action in certain program areas), no oil spills would occur, which would protect marine food subsistence resources. The Secretary of Interior choses the Program by balancing numerous factors, including environmental factors. Human Health Effects are now addressed as an Issue of Programmatic Concern in the Final PEIS.
498	Nuiqsut Meeting Transcripts	[BOEM should] incorporate information from air quality process started with Shell into any new processes.	The level of detail in the Shell plan would not be appropriate for the large-scale level of analysis of the PEIS. Plans similar to the Shell plan would be developed and incorporated on the more detailed activity-specific lease sale level of evaluation.
185	Odin Miller, Northern Alaska Environmental Center	And when I looked over the plan, I saw that it didn't do a very good job at all of addressing subsistence issues. For example, I didn't see any mention of some of the key fish species that people use in those areas, including sheefish, whitefish, other kinds of whitefish, and char. And I also didn't see any discussion of caribou.	Text in the Sociocultural Systems Sections has been revised to address concern. Additionally, an Arctic Terrestrial Wildlife and Habitat Section has been added to the Final PEIS.
186	Odin Miller, Northern Alaska Environmental Center	Nowhere in the plan does it reference the groundbreaking study published in the journal, Nature, last year by McGlade and Ekins, which says that all offshore oil in the Arctic must be left in the ground in order to keep the world within the internationally agreed on target of two degrees Celsius. A major study was published in the journal, Atmospheric Chemistry and Physics, co-authored by NASA scientist, James Hansen that said that even two degrees Celsius could have catastrophic consequences.	BOEM has incorporated the analyses from McGlade and Ekins, and Hansen into the PEIS, along with a brief discussion of how they relate to the emissions from the Proposed Action.

Comment ID	Commenter	Comment	Response
159	Oona Watkins	You need to more heavily weigh the impact that offshore drilling could have on subsistence fishing populations. G&G activities here would devastate the unique Arctic environment and the local populations that depend on it for subsistence and survival.	Pre-lease geological and geophysical activities would be analyzed in subsequent NEPA analyses prior to implementation, and are beyond the scope of the Five Year PEIS. Additional information on subsistence fishing has been added to the Final PEIS.
160	Oona Watkins	You need to more heavily weigh the impact that offshore drilling could have on protected species.	BOEM has considered impacts on ESA listed species in the PEIS; however, at this programmatic stage, BOEM is only identifying where possible leasing could occur across all the program areas over the next five year period (2017-2022). No ground disturbance is occurring at this point. Should leasing occur in any of the areas, BOEM will conduct ESA Section 7 Consultation with both the National Marine Fisheries Service and the U.S. Fish and Wildlife Service that is site-specific to a leased area that will address the possible actions stemming from lease issuance, such as exploration, development, and production. In all of BOEM's program areas, including the Arctic, BOEM considers potential impacts on both protected species and critical habitat that are site-specific to the action proposed. Note, however, that at this programmatic stage and analysis, BOEM does consider impacts broadly from this Proposed Action on protected species.
499	Point Hope Meeting Transcribed Comments	For the EIAs: commenter noted that they encompass the entire Gray Whale season-so there’s no opportunity for leasing or development.	The Presidential Withdrawal along the Chukchi Coast encompasses most of the gray whale migration route. Leasing and development could occur outside of the Presidential Withdrawal. The analyses in the PEIS discuss how impacts to marine mammals could be reduced through mitigation within the EIAs. This analysis is to provide information to the decisionmaker and no outcome is presumed.
500	Point Hope Meeting Transcribed Comments	Economic impacts to North Slope people from EIAs would be enormous.	The Population, Employment and Income Section (Chapter 4) addresses the potential economic, employment, and income benefits to that could be realized as a result of the Proposed Action. These estimates used BOEM's regional economic impact model (MAG-Plan) to produce the estimates of possible impacts. For additional information on the benefits and risks of the Alaska lease sales in the Proposed Program, see the Alaska OCS Region Benefits and Risks Section, of the accompanying 2017-2022 Outer Continental Shelf Oil and Gas Leasing Proposed Program Decision Document. The “equitable sharing” analysis includes discussions of increased wages, additional jobs, increased tax collections, and revenue sharing likely to result from the Alaska sales. Under the No Action Alternative (Alternative D) any potential socioeconomic benefits from the Proposed Action would not occur. The sale-specific Alaska EISs will provide additional socioeconomic impact analyses.

Comment ID	Commenter	Comment	Response
504	Point Hope Meeting Transcribed Comments	What about the Priboloff Rock Sandpiper in Cook Inlet? They're dying off.	USGS has estimated the population size of Pribilof rock sandpipers as about 20,000, and has suggested a vulnerability on their nesting grounds in the Bering Sea due to changes in vegetation/habitat due to climate change. Exploration activity occurs primarily during the summer open water season in Cook Inlet, while the sandpipers inhabit Cook Inlet during the winter season from about October-March, and are largely coastal. Analysis of potential impacts to this species will more appropriately take place at the lease sale level.
505	Point Hope Meeting Transcribed Comments	Could leases utilize Conflict Avoidance Agreements under OCSLA?	The Conflict Avoidance Agreement process is administered by the National Marine Fisheries Service to mitigate impacts to subsistence resources as required under the Marine Mammal Protection Act. However, BOEM recognizes that a mechanism to facilitate communication and planning to reduce or avoid conflict is a valuable approach to mitigate potential impacts from oil and gas activities. This Final PEIS analyzes requirement of a Conflict Management Plan for the Alaska program areas that would facilitate coordination and communication between local communities and OCS oil and gas activities. Determinations about specific mitigation measures and how they could be implemented generally occurs at the lease sale phase.
506	Point Hope Meeting Transcribed Comments	We want to see more studies/science on currents and wind.	While there is no specific oceanography or meteorology section within the document, the manner in which winds and currents influence impacts to resources are addressed, where relevant. The level of analysis presented is appropriate for a programmatic EIS. More thorough assessments of currents and wind will be included in lease-, or activity-specific NEPA documents prepared by BOEM.
507	Point Lay Meeting Notes	If oil spills into the inlets, it travels to the rivers, to freshwater species. We are concerned about the grayling trout. Oil spills are a big concern to the community.	Multiple anadromous or migratory fish species are discussed in the Affected Environment, Fish and EFH Section (Chapter 4). The discussion of fish is limited to federally managed species with designated EFH in the Arctic program areas. For an analysis of the impacts of an oil spill on Fish and EFH see the Potential Impacts per Resource Area Section. Further site-specific analyses on fish in the Cook Inlet will occur at the lease sale stage. BOEM has determined that no further discussion is necessary in the PEIS.
508	Point Lay Meeting Notes	The Village of Nuiqsut and the surrounding area are now seeing an increase in respiratory issues.	Human Health Effects are now addressed as an Issue of Programmatic Concern in the Final PEIS.

Comment ID	Commenter	Comment	Response
509	Point Lay Meeting Notes	Point Lay has concerns about the potential pollution of waters, which would impact human health.	Human Health Effects are now addressed as an Issue of Programmatic Concern in the Final PEIS.
510	Point Lay Meeting Notes	The community is concerned about their future generations, their health because of industrialization. We've already had half of our population decimated by famine and disease, now you want to do it again.	Human Health Effects are now addressed as an Issue of Programmatic Concern in the Final PEIS.
511	Point Lay Meeting Notes	Brown bears use the ice. Pt. Lay has a high population of brown bears. Have witnessed brown bears on ice in numbers with the walrus. Have witnessed fights between the brown bear and the walrus. Wolverines scavenging on haul out areas and beaches. This is food for land animals as well-so they are all tied together: land, ocean, and animals. Because of all the disturbances in and around Nuiqsut, the caribou have pushed toward Point Lay and further west. No caribou over to Kaktovik.	An analysis of Arctic Terrestrial Wildlife and Habitat has been added to the Final PEIS.
512	Point Lay Meeting Notes	Walrus are hauling out in Point Lay all summer-we need to expand the walrus corridor.	BOEM has determined that the EIAs considered in the PEIS reasonably capture walrus distribution and use in this area. In addition, the existing Chukchi Corridor Presidential Withdrawal affords protection for the walrus offshore Point Lay.
514	Point Lay Meeting Notes	There is no good permafrost in this area. Industrial development could cause further erosion. Could development speed up that process? We don't want to sink into the water. Is there data to show this won't happen? The Pt. Lay coastline is already eroding.	The general impact of permafrost changes on infrastructure is discussed in Appendix C. The level of detail presented regarding infrastructure is appropriate for a programmatic EIS. Location of specific shorebases or other infrastructure usage in particular towns and villages will be discussed in lease-sale or project-specific NEPA documents.
515	Point Lay Meeting Notes	Pipelines coming to shore would have erosion issues-but from offshore directly. Not aware of any resulting erosions. [NOTE: This was the community asking for more information on coastal erosion on their village and needing more data to determine if it was structurally safe given the permafrost situation.]	The level of detail presented regarding infrastructure is appropriate for a programmatic EIS. Location of specific shorebases or other infrastructure usage in particular towns and villages will be discussed in lease-sale or project-specific NEPA documents. At this time BOEM does not know exactly where the pipeline would come ashore.

Comment ID	Commenter	Comment	Response
516	Point Lay Meeting Notes	Ocean vegetation: Will this be impacted by oil and gas development? Have there been any studies done on this? With disturbances and cuttings (and related produced water), will this change ocean water?	BOEM analyzed impacts from oil and gas development on a variety of vegetation, including estuarine habitats, seagrass, and open ocean vegetation such as *Sargassum*, as well as water quality. There is no indication that ocean water has been changed by oil and gas development to the extent that it would impact coastal and estuarine resources or other ocean vegetation. The analysis in the PEIS shows that impacts on coastal and estuarine habitats are expected to be minor, and impacts on pelagic communities, including vegetation such as *Sargassum*, are expected to be negligible. Impacts on water quality are expected to be minor.
517	Point Lay Meeting Notes	Keep the ships away until the beluga harvest is over. This could be through mid-July.	Current mitigation in the Chukchi Sea includes a closure to vessel traffic until the open water period for safety reasons, currently mid-July. This also minimizes impacts on marine mammals and birds traversing the lead systems. Additional time-area closures could be implemented at the lease sale level.
518	Point Lay Meeting Notes	With CAA's, whalers know that they are safe if there is any activity out there. CAAs are crucial to help protect subsistence. Can BOEM do something similar to CAAs?	The Conflict Avoidance Agreement process is administered by the National Marine Fisheries Service to mitigate impacts to subsistence resources as required under the Marine Mammal Protection Act. However, BOEM recognizes that a mechanism to facilitate communication and planning to reduce or avoid conflict is a valuable approach to mitigate potential impacts from oil and gas activities. This Final PEIS analyzes requirement of a Conflict Management Plan for the Alaska program areas that would facilitate coordination and communication between local communities and OCS oil and gas activities. Determinations about specific mitigation measures and how they could be implemented generally occurs at the lease sale phase.
519	Point Lay Meeting Notes	UAF is conducting an ocean current study-this could help with the spill concern issue.	There is not enough specific information provided in the comment to locate a specific study to update the overall ocean currents discussions. The PEIS currently includes the most up-to-date research and information for BOEM to determine the fate and transport of oil following a CDE in the Arctic. BOEM will be interested in any data/analyses that UAF produces and will consider inclusion in our future analyses.
520	Point Lay Meeting Notes	International regulators forum for all places that have oil and gas development where we will share equipment, etc. It would require international cooperation. [The comment was offered within the context of oil spill response and response capabilities.]	Chapter 3, as well as other spill-related sections of the PEIS, note the regional staging of spill equipment. The programmatic nature of this document warrants only general discussion of spill response capabilities. Lease sale-specific EISs and project-specific documents will provide further detail regarding spill response capabilities. Oil and gas operations in the U.S. OCS waters could include international support for oil spill response.

Comment ID	Commenter	Comment	Response
521	Point Lay Meeting Notes	If there is an oil spill, can you help our community train in order to help with cleanup efforts? Help our communities get prepared and educated to help.	The programmatic nature of this document warrants only general discussion of spill response capabilities. Lease sale-specific EISs and project-specific documents will provide further detail regarding spill response capabilities. The employment of local communities to assist in spill cleanup could be an option.
522	Point Lay Meeting Notes	Are there regulations/guidelines for when Shell or any oil and gas company conducts safety drills? The community gets no feedback, communication, warning, or information on these. We got a call right before one was conducted and I didn't know what to do or who to alert.	The issue of regulatory and safety procedures is briefly discussed in several sections of the PEIS to provide a broad overview within a programmatic context (see Section 1.3, Appendix I and Appendix J). It is noteworthy that the PEIS, as a programmatic document, provides a broad analysis of the projected levels of exploration, development, production, and decommissioning activities which result from leasing during the 2017-2022 period. Further, more detailed analysis of site-specific issues and impacts, as well as regulatory compliance and safety, will be conducted in future lease sale EISs and specific project plans. In regards to regulations or guidelines regarding operator safety drills, BSEE would be responsible for determining the nature and frequency of safety drills, training, etc. on a project-specific basis. No revisions to the PEIS are required. The following link provides additional detail on regulatory and safety reform undertaken by BOEM and BSEE as well. http://www.bsee.gov/BSEE-Newsroom/Press-Releases/2016/Interior-Department-Releases-Final-Well-Control-Regulations-to-Ensure-Safe-and-Responsible-Offshore-Oil-and-Gas-Development/
6	Princess Lucaj	This pipeline, and its accompanying service road, would cross the migration paths of at least three major caribou herds. Pipelines and roads have been documented as having significant negative impacts on caribou migration and populations throughout the Arctic. All three of these herds are currently suffering declining populations and are experiencing stress due to climate change.	An analysis of Arctic Terrestrial Wildlife and Habitat has been added to the Final PEIS.
7	Princess Lucaj	The Final Environmental Impact Assessment must reference the major 2015 study by McGlade and Ekins, published in Nature, which highlighted the Arctic region as the one place on the planet that fossil fuel extraction should be altogether avoided in order to keep our global temperature rise below 2C.	This study has been incorporated into the analysis.

Comment ID	Commenter	Comment	Response
9	Princess Lucaj	The PEIS fails to include key fish species in its analysis. These include burbot, char, grayling, and whitefish species.	The discussion of fish is limited to managed species with designated EFH in the Beaufort Sea and Chukchi Sea Planning Areas (see also Appendix C, Fish and EFH Section). The species mentioned in the comment are not managed and have no EFH within the Beaufort Sea and Chukchi Sea Planning Areas. Therefore, BOEM has determined that no further discussion is necessary at the programmatic level of analysis.
445	Public Meeting in Kotzebue	Northern passageway is going to open vessel impacts – [this is] a greater concern than oil well.	Increased circum-Arctic vessel traffic is considered in the PEIS as a reasonably foreseeable future action.
80	Rachel Bonnette	In terms of acoustics, protected species and fisheries, oil spill impact analysis and human environment, I believe that all scenarios and associated outcomes have been equally weighed in the findings. The one item I did not understand was why a hunting season near Alaska was relevant to the consideration of when to drill. I understand quality of life for hunters in relation to leisure activities. However, drilling for oil to keep our world turning (think cars, boats, clothes, plastics, etc.) and economy going is much more important than considering someone's ideal time of year to hunt. Unless this area near Alaska is solely reliant on hunting to provide food for their families, I don't think it is a big enough factor to sway when the area can be an active drill site. I appreciate the respect given to hunters by having the timing of year factored into the research, but don't think it should be considered heavily enough to potentially sway drilling activity time.	The time of year to hunt is significant because certain subsistence species are available only at certain times of the year. Of most significant importance for OCS activities is the timing of the migration of the bowhead whale migration. Subsistence hunting and fishing is central to the culture of the Iñupiat, particularly for bowhead whales; see Chapter 4, Sociocultural Systems. Text has been revised per comment.
66	Rev. Deanna Vandiver	Thank you for using this draft review period to more deeply consider the impacts of displacement, community loss, and the psychic stress of communities being forced to choose between a job and land to come home to. As demonstrated by the existing draft, this plan impacts a deeply interconnected web of existence. Please make more space in your impacts analysis for this lived experience in coastal communities.	The level of analysis is appropriate for a programmatic EIS. The PEIS analyzes potential sociocultural impacts in Chapter 4, Sociocultural Systems and Potential Impacts per Resource Area Sections. In addition, displacement and community loss are addressed in the following sections in Chapter 4: Population, Employment, and Income; Land Use and Infrastructure; and Environmental Justice.

Comment ID	Commenter	Comment	Response
551	Rev. Deanna Vandiver	If it is true that approximately 80% of the current oil reserves needs to remain in the earth prevent the 2 degree climate shift that will result in a new coast line that begins near Pine Bluff, Arkansas, then it is essential that we not understate the impacts of the OCS Oil & Gas Leasing Program.	On August 1, 2016, the Council on Environmental Quality issued Final Guidance for the Consideration of Greenhouse Gas Emissions and the Effects of Climate Change in National Environmental Policy Act Reviews. The Final PEIS addresses the effects of climate change consistent with that guidance, including describing the sensitivity of resources to future impacts because of a changing climate. BOEM has prepared a new technical report (available at www.boem.gov) that quantifies the potential downstream greenhouse gas emissions and the social cost of carbon associated with ongoing OCS Program and 2017-2022 Program oil and gas activities and consumption of oil and gas produced on the OCS.
376	Rex Rock, Arctic Slope Regional Corporation	BOEM must acknowledge the important role Alaska native corporations play in the scoping process. In Section 6 of the Draft PEIS (Consultation and Coordination), BOEM briefly outlines the process by which it engaged in the scoping for and distribution of the Draft PEIS. We suggest that BOEM also outline the process by which it engaged in consultation with Indian tribes as well as Alaska Native corporations in this section. We also recommend adding Alaska Native regional and village corporations affected by Alaska OCS oil exploration, development, and production to the list of entities to which OCS Oil and Gas Leasing Program documents are distributed. We urge BOEM to invite Alaska Native corporations to consult directly with the agency on the Draft PEIS and at every stage in the development of the OCS Oil and Gas Leasing Program. In conclusion, instead of setting aside large swaths of the Arctic OCS, BOEM should, in adopting the Proposed Action, emphasize that Traditional Knowledge will be integrated into active Arctic OCS management, commit to maintaining established monitoring and mitigation measures to protect marine mammals and subsistence, and continue to invest in collaborative research and regular consultation with local communities.	There are multiple locations in the PEIS where subsistence activities and traditional knowledge are highlighted (e.g., Sociocultural Systems Sections). BOEM incorporated summaries of both subsistence activities and traditional knowledge to the maximum practical extent, given the programmatic nature of the analysis and NEPA requirements. It is also noteworthy that the PEIS provides a broad analysis of the projected levels of exploration, development, production, and decommissioning activities, which could result from leasing during the 2017-2022 period. Further analysis of site-specific issues and impacts will be conducted in lease sale EISs and specific project plans. This will include further details resulting from traditional knowledge.

Comment ID	Commenter	Comment	Response
377	Rex Rock, Arctic Slope Regional Corporation	Traditional knowledge should not be used solely to identify sensitive areas, but should be employed in active Arctic OCS management to ensure the environment, our communities, and subsistence are fully protected. We are concerned that Alternatives B(1)(b) and B(2)(b) of BOEM's Draft PEIS, which contemplate the total exclusion of Environmentally Sensitive Areas (EIAs) from the Beaufort or Chukchi Sea Program Areas, or, in the alternative, contemplate application of programmatic mitigation (through temporal closures) that would effectively exclude the EIA's, reflect a lack of confidence in, or a lack of commitment to, the active OCS mitigation programs that BOEM, North Slope communities, and Traditional Knowledge holders have worked so hard to develop. We strongly urge BOEM to avoid setting aside potential new EIAs identified in the Draft PEIS. The merging of Traditional Knowledge and Western science has allowed our communities to work with BOEM to both identify sensitive areas while also properly mitigating the impacts of active exploratory activities within those areas, supporting the co-existence of the environment, subsistence, and economic development. BOEM should continue to support the monitoring and mitigation programs it helped to develop with the input of Traditional Knowledge holders, and allow for active Arctic OCS management with proper mitigation.	BOEM acknowledges existing measures designed to deconflict use of the Arctic OCS and appreciates the long history of coordination that has gone into making these efforts successful. In the Final PEIS, BOEM included how development of an Alaska Conflict Management Plan as a condition of plan approval could mitigate impacts in lieu of excluding an EIA.
379	Rex Rock, Arctic Slope Regional Corporation	Finally, we urge BOEM to recognize within its impact assessment the dual realities of protecting the social and economic well-being of our communities - our Iñupiat culture and communities depend upon a healthy ecosystem and the subsistence resources it provides as well as future oil and gas development as the foundation of a sustained economy.	The Population, Employment, and Income and Sociocultural Systems Sections in Chapter 4 describe social and economic well-being, the Iñupiat culture, and subsistence resources in the Beaufort and Chukchi Sea Program Areas. The impact analyses for socioeconomic and sociocultural resources (Chapter 4) describe the potential results of the Proposed Action which would provide a future for oil and gas development as the foundation of a sustain economy. The PEIS describes aspects of the ecosystem and potential impacts regarding: air quality, water quality, marine benthic communities, coastal and estuarine habitats, pelagic communities, marine mammals, birds, and fish and essential fish habitat.

Comment ID	Commenter	Comment	Response
380	Rex Rock, Arctic Slope Regional Corporation	The rationale for holding fewer Arctic lease sales is logically inconsistent. The Draft PEIS states that fewer lease sales are scheduled for Alaska Program Areas "where offshore oil and gas experience is much more limited." However, new exploration should not be delayed for want of experience, nor is this even a valid concern. BOEM itself acknowledges that OCSLA's stated decision process allows for the adaptive management and incorporation of new technologies and regulations at each stage of oil and gas development. Delaying lease sales is not necessary because, under OCSLA and lease terms, new regulations and Best Available and Safest Technology (BAST) determinations apply to existing leases. Draft PEIS at 2-17. In developing the Beaufort and Chukchi Sea Programs, we encourage BOEM to avoid further set-asides and place more emphasis on merging Western scientific data and Traditional Knowledge to analyze the potential impacts of industry activities to marine mammals, subsistence and the Arctic environment and to identify appropriate mitigation measures. Traditional Knowledge was utilized to develop mitigation measures that have been successfully employed in the past, and those measures, rather than new set-asides, deserve more emphasis in the Draft PEIS.	The decision on where and when to schedule lease sales during a Program is made by the Secretary based on factors identified in OCSLA. The rationale for the timing and number of lease sales proposed for the Arctic program areas is provided in the documents prepared during Program development (http://www.boem.gov/Five-Year-Program/). The development of the PEIS provides information to the Secretary on potential environmental impacts associated with leasing activities, as well as alternatives that, if implemented, could avoid or minimize impacts. BOEM relies on both traditional knowledge (TK) and western science in identifying potential impacts to marine resources, including birds and marine mammals. This is particularly true in the Arctic, where TK has significantly informed marine mammal research. The Final PEIS includes analysis of implementation of an Alaska Conflict Management Plan to reduce potential impacts to subsistence users; this concept is rooted in existing practices, including mitigation measures informed by TK, in place in the Arctic to deconflict oil and gas activities and subsistence use.
381	Rex Rock, Arctic Slope Regional Corporation	ASRC recognizes that NEPA mandates an agency consider a No Action Alternative. Accordingly, ASRC does not object to the inclusion of Alternative C in the Draft PEIS. However, Alternatives B effectively represents a second No Action Alternative for the Arctic OCS, as it would significantly reduce the viability of an Arctic OCS leasing program. Alternatives B(1)(a) and B(2)(a) would prohibit new leasing in the entire Beaufort and Chukchi Program Areas. The Secretary, in adopting Alternative A (the Proposed Action), can achieve the proper balance by integrating Traditional Knowledge into active Arctic OCS management, committing to monitoring and mitigation measures to protect marine mammals and subsistence, and continuing to invest in collaborative research and consultation with local communities. ASRC believes Alternative B does not adequately balance environmental and cultural concerns against the capacity of industry, in partnership with the federal government and our communities, to safety explore for and produce oil and gas on the Arctic OCS. BOEM should reassess whether Alternative B is an appropriate alternative.	OCSLA specifically mandates the development of an OCS oil and gas program every five years. While OCSLA does not mandate a particular level of leasing or production, BOEM believes that the alternatives analyzed in this PEIS present a range of reasonable alternatives to meet the Purpose and Need identified at the beginning of Chapter 1. The activities corresponding to each alternative are analyzed in view of current environmental guidelines, criteria or standards. NEPA requires Federal agencies to analyze alternatives that may reduce the impacts of the Proposed Action; there is no requirement to analyze larger alternatives with more impacts. The PEIS analyzes mitigation measures up to and including exclusions of EIAs to reduce impacts. This information will be used to inform future decisions. The analyses provide information to the decisionmaker and no outcome is presumed.

Comment ID	Commenter	Comment	Response
382	Rex Rock, Arctic Slope Regional Corporation	Infrastructure investments driven by Arctic OCS development will power local North Slope economies. The Draft PEIS does recognize that the development of Arctic OCS oil and gas resources would require the construction of high-value onshore infrastructure to support offshore oil and gas activities, including service bases, pipelines, roads, onshore processing facilities, and oil spill response bases. The Draft PEIS downplays the potential benefits of future oil and gas infrastructure investments and fails to recognize the collaborative efforts ongoing in the region to ensure these developments meet the needs of North Slope communities. BOEM should acknowledge these efforts in the Final PEIS. On the other hand, in the absence of resource development, our region is unlikely to see meaningful new investments in infrastructure.	BOEM recognizes that infrastructure investments in the Arctic can lead to economic growth in North Slope communities and the state of Alaska. The discussion in the Population, Employment, and Income, Land Use and Infrastructure, Sociocultural Systems, and Environmental Justice Sections has been revised to reflect the full range of impacts associated with oil and gas development in the Arctic.
589	Rex Rock, Arctic Slope Regional Corporation	BOEM overstates the potential impacts of the Proposed Program on the Arctic. BOEM indicates that the environmental analyses presented in the Draft PEIS are based on assumptions about future activity types and levels. However, the Draft PEIS concludes that several Impact Producing Factors ("IPFs") associated with the OCS Oil and Gas Leasing Program could cause "moderate" to "major" impacts within the Beaufort and Chukchi Sea Program Areas without fully taking into consideration reasonable assumptions about measures that "without question" will be taken to avoid or minimize impacts through existing regulations, mitigation measures, and consultation with the affected communities. Many of the impacts which BOEM attributes to the Proposed OCS Oil and Gas Leasing Program can be avoided or minimized with existing regulations, other mitigation measures and consultation with the affected communities. Myriad federal regulations already govern oil and gas operations on the Federal OCS. Rather than attempt to analyze the scope of protections afforded by Federal regulations here, ASRC requests that BOEM inventory existing Federal regulations related to monitoring and management of proposed impacts. It would be helpful if BOEM would provide this information in a chart within the Final PEIS Appendices in a format that allows stakeholders to better understand how existing regulatory authorities address potential impacts from the OCS Oil and Gas Leasing Program. Additionally, many of the impacts highlighted by BOEM can be avoided or minimized through consultation with the affected communities.	The analysis of impacts for the Arctic program areas considers varying levels of activity (i.e., the low, medium, and high case scenarios). The discussion of potential impacts captures the uncertainty inherent in a programmatic analysis by evaluating the range of impacts that could occur depending on the level of development. Subsequent NEPA analyses would be conducted if a lease sale moves forward in one or both of these program areas and would provide more specific impacts analysis related to the anticipated development. BOEM considered existing Federal regulations in the analyses in both the Draft and Final PEIS. Relevant mitigation measures and regulations can be found in Appendices I and J, respectively. In addition, BOEM consults with potentially affected communities at all stages of Program development, including the Five Year Program (refer to Chapter 6 of the Final PEIS). BOEM also analyzed the requirement of a Alaska Conflict Management Plan that would be required for any lease issued in an Alaska Program Area during the 2017-2022 Program. If adopted, this mitigation measure would require a good faith effort by operators to reduce conflict between oil and gas operations and subsistence use.

Comment ID	Commenter	Comment	Response
590	Rex Rock, Arctic Slope Regional Corporation	ASRC appreciates BOEM's efforts to analyze potential impacts from the Proposed OCS Oil and Gas Leasing Program, particularly impacts to our communities and subsistence. However, as BOEM appropriately acknowledges, "fully predicting the degree of effect is impossible at the programmatic stage considered here." BOEM should also ensure this statement appears in its analysis of IPFs at sections 4.4.1.16 (Sociocultural Systems "Noise, Traffic, Bottom/Land Disturbance, Visible Infrastructure, and Space Use Conflicts") and 4.4.1.17 (Environmental Justice "Noise, Routine Discharges, Bottom/Land Disturbance, Air Emissions, Lighting, Visible Infrastructure, and Space-Use Conflicts") of the Draft PEIS.	The statement appearing in Section 4.4. applies to all resource areas being analyzed, including Sociocultural resources and Environmental Justice.
591	Rex Rock, Arctic Slope Regional Corporation	Arctic OCS development benefits local and state economies. Continued development of the Arctic OCS would be a significant boon to North Slope communities and to Alaska, providing multiple economic benefits. We think the Draft PEIS fails to adequately capture the benefits of Arctic OCS development or, perhaps more importantly, the economic consequences to our communities of failing to pursue Arctic OCS development. We encourage BOEM to place emphasis on the economic consequences to our communities of failing to pursue an "all of the above" strategy, including OCS exploration and development, and thereby extending the life of TAPS. The reality is this: the continued viability of TAPS "which is contingent upon further development of the Arctic OCS" is critical to the economic and social wellbeing of Iñupiat communities on the North Slope. The Final PEIS should reflect this reality.	For additional information on the benefits (and risks) of the Alaska lease sales in the Proposed Program, see the Alaska OCS Region Benefits and Risks Section of the accompanying 2017-2022 Outer Continental Shelf Oil and Gas Leasing Proposed Program Decision Document. The "equitable sharing" analysis includes discussions of increased wages, additional jobs, increased tax collections, and revenue sharing likely to result from the Alaska sales. Under the No Action Alternative (Alternative D) any potential socioeconomic benefits from the Proposed Action would not occur. Additional socioeconomic analyses will be conducted at subsequent stages of the leasing process.
592	Rex Rock, Arctic Slope Regional Corporation	Continued Arctic OCS development is critical to both the long-term energy security of the United States and to the nation's economy. This point cannot be overstated, especially now that BOEM has chosen to remove the Atlantic from the 2017-2022 Oil and Gas Leasing Program. BOEM should recognize the value of an Arctic OCS lease sale program and accordingly should include the proposed 2020 lease sale in the Beaufort Sea and the proposed 2022 lease sale in the Chukchi Sea in the Final 2017-2022 Program.	The Population, Employment and Income Section (Chapter 4) addresses the potential economic, employment, and income benefits to that could be realized as a result of the Proposed Action. These estimates used BOEM's regional economic impact model (MAG-Plan) to produce the estimates of possible impacts. For additional information on the benefits and risks of the Alaska lease sales in the Proposed Program, see the Alaska OCS Region Benefits and Risks Section, of the accompanying 2017-2022 Outer Continental Shelf Oil and Gas Leasing Proposed Program Decision Document. The “equitable sharing” analysis includes discussions of increased wages, additional jobs, increased tax collections, and revenue sharing likely to result from the Alaska sales. Under the No Action Alternative (Alternative D) any potential socioeconomic benefits from the Proposed Action would not occur. Additional socioeconomic analyses will be conducted at subsequent stages of the leasing process.

Comment ID	Commenter	Comment	Response
442	Roger Kaye	The region's harsh conditions-its remoteness, and extreme temperatures, wind, and fog-combine to make mishaps more likely, and effective response unlikely.	The PEIS identifies and discusses the differences and challenges of spill response in the Alaskan environment in the Accidental Spills and Catastrophic Discharge Events Section, Chapter 4, dealing with ice, cold, and limited daylight conditions. Individual resources potentially impacted by a catastrophic discharge event (CDE), including those in Alaska, are discussed in the Potential Impacts per Resource Area Section, Chapter 4. This analysis of potential impacts is broad and considers entire planning areas. At subsequent lease sale stages, more specific information will be available regarding the location and level of activity, spill risk of proposed activities, and specific environmental resources in the area. At subsequent stages, BOEM might also conduct Oil Spill Risk Analysis modeling to better estimate spill risk, spill trajectories, and probability of contact with an environmental resource. Spill response methods and specifics would be analyzed in more detail in the individual lease sale stage environmental review documents as well as in spill response plans submitted as part of lessees' Exploration Plans and Development and Production Plans.
191	Sandy Henschel	On page S-8 (Draft PEIS), there is mention of how the BOEM will continue to consider beluga whale habitat. One of your scientists described how one section in the middle of Cook Inlet would be a protected area. But that leads me to wonder, why only one small section right in the middle? Whales travel hundreds, and thousands of miles. It’s not like they can stay in one small part of the inlet to be safe from oil, swimming in circles. Is that really supposed to protect them?	Areas removed from leasing for beluga whales in Cook Inlet are based on critical habitat as determined by the National Marine Fisheries Service. The area analyzed under Alternative B as an exclusion is in the farthest north portion of the program area and includes the only area of critical habitat that overlaps with the program area.

Comment ID	Commenter	Comment	Response
293	Sarah Chasis, Natural Resources Defense Council	The Draft PEIS does not propose sufficient mitigation, and does not analyze the effectiveness of mitigation. CEQ regulations explicitly require discussion of mitigation measures in a PEIS. Thus, the PEIS should not simply assume that other laws and regulations will mitigate impacts, but instead should analyze whether these measures are, in fact, sufficient to minimize negative environmental impacts. The PEIS should discuss and analyze mitigation measures recommended in post-BP Deepwater Horizon expert reviews including those that have been adopted by regulation and those that have not. The PEIS should consider alternatives and mitigation measures for underwater noise, which is the most prevalent form of environmental impact from offshore exploration, development, and production activities. Among the mitigation measures for noise that the PEIS should include are marine mammal protection areas using the best available scientific evidence, including but not limited to the density models newly available through NOAA's CetMap program. The PEIS should also consider alternatives and mitigation around quieting technologies, which are among the most promising means of mitigating ocean noise, with potentially significant long-term reductions in cumulative exposures and impacts on marine species. Given the certain availability of quieting technologies during the 2017-2022 period, and the potential of these technologies to significantly reduce the environmental impacts of the offshore leasing program on many marine species, the PEIS must develop and analyze alternatives and/or mitigation measures focused on their adaption.	The PEIS broadly characterizes the types of activities and the environmental impacts that could occur. Appendix I in the PEIS identifies the suite of existing mitigation measures BOEM employs to minimize or avoid impacts. Additional mitigation measures are identified in the PEIS that could be useful in reducing or avoiding impacts, including activity restrictions, time-area closures, and conflict management processes. Decisions on specific mitigation measures, including their design and implementation, could be made throughout the phased leasing process, as more detailed project information becomes available.
294	Sarah Chasis, Natural Resources Defense Council	The PEIS provides no analysis on the potential impacts of the Proposed Action on the Cook Inlet beluga whale, instead discussing general impacts on marine mammals in one part of the impacts analysis and identifying the beluga whale as an inhabitant of Cook Inlet in another.	BOEM recognizes the potential for impact to this population and has analyzed in the PEIS an alternative that would exclude areas of critical habitat from consideration for leasing. The alternative includes employing temporal closures for certain activities in the Cook Inlet Program Area to limit impacts on beluga whales.

Comment ID	Commenter	Comment	Response
296	Sarah Chasis, Natural Resources Defense Council	BOEM is arbitrary in concluding that acoustic impacts on marine mammals would be "moderate" rather than "major." The PEIS contains scant analysis of acoustic impacts; the agency does not attempt to engage in region- and species-based evaluation, let alone in the quantitative analysis of noise impacts that has become routine in programmatic environmental reviews. BOEM's conclusion, that acoustic impacts cannot possibly threaten the "viability or integrity" of marine species and therefore cannot constitute, by its definition, a "major" environmental effect, is simply untenable. None of these findings are considered or cited in the PEIS, or, for that matter, in any of the environmental impact analyses that BOEM has published to date for geophysical activities. BOEM justifies its conclusion about harm in a strangely self-referential section, titled Summary and Discussion of Applying Knowledge of Acoustics to Decision, "that does not actually contain any environmental analysis"..this is not analysis, nor is there any analysis of the agency's acoustic impacts in the rudimentary primer on noise that precedes it. It is impossible to trace a rational connection between the agency's conclusions and the facts that it presents, as the law requires; and to the extent that the agency had considered best available science "including but by no means limited to the papers on behavioral impacts cited in this comment letter, which were not, apparently, considered” it would necessarily have reached a different conclusion.	The analysis of acoustic impacts in the PEIS is in compliance with recent CEQ guidance on programmatic reviews (CEQ 2014) and is an appropriate level of detail for the decision at hand. The analysis is at a national level, and the scope of impacts is described broadly. The anticipated context and intensity of impacts from noise as a result of OCS oil and gas E&D activities are discussed in relevant resource sections in Section 4.4. The information presented under the broader heading “Acoustics” is now in Appendix D and is not intended as an analysis but rather as contextual information for the material in Section 4.4. Analysis on a regional level or a species-specific basis is provided if appropriate for consideration of the impacts; however, general impact pathways are the same across many species of marine mammal. More specific information will be provided at subsequent stages of environmental review for any lease that is scheduled for the 2017-2022 Program. Additional analyses (including quantitative if necessary) could inform the design and implementation of mitigation measures to reduce impacts to marine mammals from noise. BOEM does not conclude that “acoustic impacts cannot possibly threaten” marine mammals. BOEM has determined that impacts from noise to marine mammals as a result of activities under the Proposed Action could range from negligible to moderate. The “viability or integrity” of marine mammal populations is not expected to be threatened by these activities, although certain individuals could experience irreversible impacts.
297	Sarah Chasis, Natural Resources Defense Council	Any informed environmental review would acknowledge this: that the noise produced by routine operations may very well have major impacts on marine mammal populations, depending on the species, the extent of activity, and other factors; that some populations in BOEM's planning areas are likely to be particularly vulnerable to acoustic perturbation; and that the conventional mitigation measures summarized at Appendix I do not address the behavioral, masking, and chronic physiological impacts that, in most if not all circumstances, represent the leading mechanisms of population-level harm.	BOEM's analysis of acoustic impacts in this PEIS is appropriate for a programmatic document (CEQ 2014). The findings for marine mammals for noise are based on impact level definitions provided in Section 4.1.2 and acknowledge the potential for serious impacts depending on the species, the location, and the sound source. The mitigation information provided is broad scale for the PEIS and is appropriate for the temporal and spatial scales required in the PEIS document. Appendix D addresses the difficulty in developing mitigation measures for chronic behavioral and masking effects beyond small scales; however, BOEM has addressed some of the chronic influences mentioned and relays the importance of these chronic impacts in Appendix D. The analysis of specific acoustic impacts, including source levels and species that could be affected, is more appropriate for a lease sale EIS. Analysis at a programmatic level allows for broad descriptions of mitigation measures that could be used for oil and gas activities; however, a lease sale EIS is the appropriate place to identify which mitigation measures should be applied and the degree to which they could be expected to reduce impacts.

Comment ID	Commenter	Comment	Response
558	Sarah Chasis, Natural Resources Defense Council	Any program to offer new leases must take into account the long-term nature of a lease commitment and the resulting constraints that it would place on the U.S.'s efforts to achieve zero net emissions. As the IPCC warns, "Infrastructure developments and long-lived products that lock societies into GHG-intensive emissions pathways may be difficult or very costly to change." Once new production begins on future leases, industry is likely to continue to produce on those leases over long timelines to maximize marginal income, regardless of corresponding market conditions. This investment "lock-in" effect is particularly strong for offshore oil and gas in undeveloped areas because of the huge infrastructure outlays required. As a result, new leases create momentum for future over-production that is resistant to carbon regulation and competition from renewables.	The Five Year Program does not result in an irretrievable or irreversible commitment of resources, rather the Five Year is a broad planning process that sets the stage for decisionmaking for future lease sales. Leases may or may not happen; exploration and production under leases may or may not happen. Over the protracted life of a Five Year Program, new laws, policies, or technologies may also be introduced that affect the supply and demand of oil and gas. BOEM expects that if such a climate-policy scenario were to unfold that the market would drive different consumption patterns, ultimately through a change in price. Future laws, regulations and policies would be necessary to drive market changes in the energy sector to a cleaner or more diverse or climate-friendly energy portfolio. The U.S. Intended Nationally Determined Contributions scenario that informed the 2015 Paris Agreement does not assume "zero" oil and gas production or consumption in the future, but rather declining emissions from coal and oil. The U.S. has made notable progress towards its 2025 emissions reduction target through measures identified in the President's Climate Action Plan. BOEM recognizes this possibility, but must also work within the organizing principal of OCSLA which directs, subject to environmental safeguards, the expeditious development of OCS resources. Consistent with the requirements of NEPA, BOEM considers the equivalent of no leasing or reduced leasing in a subset of OCS Program Areas. Those options are reflected in Alternatives C and D.
559	Sarah Chasis, Natural Resources Defense Council	With respect to solar power in particular, the fact that solar power is now the number one source of new generation calls into question BOEM's assumptions that all renewable energy sources will make up only 18% of electricity generation in 2040, behind coal and natural gas.	BOEM does not assume a need for oil and gas over the next 70 years and recognizes that the role of energy conservation and renewable energy sources in meeting the energy demands of this country continues to grow. BOEM uses demand projections from USEIA, which are the official U.S. government projections and are therefore appropriate to include in this analysis. BOEM maintains that the USEIA information is an authoritative source where the underlying assumptions regarding each energy sector are clearly specified in source documentation, including current laws and regulations considered. In BOEM's specific analysis likely energy substitutes for forgone OCS production, MarketSim incorporates a modified NEMS version of the USEIA's 2016 Annual Energy Outlook (AEO) reference case (updated to reflect the Clean Power Plan). BOEM's market substitution analysis shows that alternative energy is not a reasonable alternative to some or all oil and gas OCS development.
560	Sarah Chasis, Natural Resources Defense Council	BOEM should use oil spill trajectory modeling to identify important areas that would be jeopardized by development before leasing areas are identified, not after.	Chapter 1 of the PEIS explains why oil spill risk modeling is not undertaken at the programmatic stage. Oil spill trajectory modeling is an integral component of the lease sale stage review. In the PEIS, BOEM estimates the number of oil spills that may be expected in each program area and considers more broadly the potential effects from different sized oil spills.

Comment ID	Commenter	Comment	Response
561	Sarah Chasis, Natural Resources Defense Council	Cascading consequences extend to human residents because “biodiversity and the natural environment remain integral to well-being of Arctic peoples, providing not only food but the everyday context and basis for social identity, cultural survival and spiritual life.” These foods also lower the risk of metabolic diseases in Alaska Natives. All of these important values are threatened by oil and gas activities.	Human Health Effects are now addressed as an Issue of Programmatic Concern in the Final PEIS. The Sociocultural Systems Section in Chapter 4 addresses several of the general concepts that are germane to the IPFs analyzed.
567	Sarah Chasis, Natural Resources Defense Council	The PEIS improperly analyzes the cumulative impacts of oil spills. The PEIS also specifically fails to analyze the potential cumulative impacts of catastrophic spills, because they are not “reasonably foreseeable.”	The probability of a catastrophic spill was evaluated in Chapter 3; the likelihood occurrence was discussed in context of the time horizon considered. Resource-specific impacts of potentially catastrophic spills are discussed in the Accidental Spills and Catastrophic Discharge Events Section.
568	Sarah Chasis, Natural Resources Defense Council	The PEIS must analyze how other aspects of response, such as the use of booms, boats, and in situ burning, could affect the environment.	The PEIS acknowledges that spill response activities may impact marine and coastal birds, air quality (particularly in situ burning), and on land use and infrastructure in Chapter 4, Accidental Spills and Catastrophic Discharge Events. The text has been amended to include a broader discussion of oil spill response impacts on other resource areas such as marine mammals and fish. More thorough assessments of impacts from general oil spills are appropriate for inclusion in lease-, or activity-specific NEPA documents prepared by BOEM.
569	Sarah Chasis, Natural Resources Defense Council	The PEIS fails to analyze the potential direct, indirect, and cumulative impacts of climate change on the OCS leasing areas. The impacts of climate change must also be included as part of the cumulative impacts analysis. For example, as Interior’s Climate Change Adaptation Plan points out, sea level rise may damage offshore oil and gas infrastructure, causing spills. In addition, the PEIS states that sea level rise is one of the most substantive threats to coastal habitat. The PEIS concludes that cumulative impacts on coastal and estuarine habitats will be minor to major, “depending on the location and mainly due to possible sea level rise.” Yet, the PEIS provides no description of sea level rise in the various proposed program areas, nor any analysis of how those specific levels will affect coastal habitat or the risk of spills.	On August 1, 2016, the Council on Environmental Quality issued Final Guidance for the Consideration of Greenhouse Gas Emissions and the Effects of Climate Change in National Environmental Policy Act Reviews. The Final PEIS addresses the effects of climate change consistent with that guidance, including describing the sensitivity of resources to future impacts because of a changing climate. BOEM has prepared a new technical report (available at www.boem.gov) that quantifies the potential downstream greenhouse gas emissions and the social cost of carbon associated with ongoing OCS Program and 2017-2022 Program oil and gas activities and consumption of oil and gas produced on the OCS.

Comment ID	Commenter	Comment	Response
570	Sarah Chasis, Natural Resources Defense Council	The PEIS then concludes that the cumulative impacts on marine benthic communities will be minor to moderate. Without an analysis of how a 0.31 pH increase will affect the benthic community, this conclusion is unfounded. The PEIS must provide an accurate and comprehensive analysis of the impacts of the Program in light of climate change under the AEO2015 scenario. Should the Final PEIS identify alternative energy scenarios, the impacts analysis must be based on those scenarios, as well.	On August 1, 2016, the Council on Environmental Quality issued Final Guidance for the Consideration of Greenhouse Gas Emissions and the Effects of Climate Change in National Environmental Policy Act Reviews. The Final PEIS addresses the effects of climate change consistent with that guidance, including describing the sensitivity of resources to future impacts because of a changing climate. BOEM has prepared a new technical report (available at www.boem.gov) that quantifies the potential downstream greenhouse gas emissions and the social cost of carbon associated with ongoing OCS Program and 2017-2022 Program oil and gas activities and consumption of oil and gas produced on the OCS.
571	Sarah Chasis, Natural Resources Defense Council	Finally, the structure of the PEIS further inhibits an adequate analysis of the cumulative effects of climate change. By placing the description of climate change in an appendix, the cumulative effects analysis does not build off the climate change impacts.	The PEIS analysis of effects related to climate change has been revised. The description of climate change in the PEIS has been expanded.
572	Sarah Chasis, Natural Resources Defense Council	The Draft PEIS fails to analyze the direct, indirect, and cumulative impact of fossil fuels developed as a result of the Five Year Program. The Five Year Program assumes that 4-20 billion barrels of oil equivalent will be produced from the areas considered for lease. Yet, the PEIS ignores any impacts that would result from the burning of these fossil fuels. CEQ guidance also explains that downstream emissions should be considered in a NEPA analysis. The PEIS for the Five Year Program is a particularly appropriate place to consider the downstream impact of OCS emissions because it is at this stage that BOEM can best assess how new oil and gas from OCS leasing can fit with our national policy and commitments to reduce global warming. A discussion of the cumulative impacts of fossil fuel consumption based on the baseline energy forecast is particularly important because it would reveal a “more comprehensive picture of the consequences of multiple Proposed Actions” that rely on this energy forecast.	On August 1, 2016, CEQ issued Final Guidance for the Consideration of Greenhouse Gas Emissions and the Effects of Climate Change in National Environmental Policy Act Reviews. The Final PEIS addresses the effects of climate change consistent with that guidance, including describing the sensitivity of resources to future impacts because of changing climate. BOEM has also quantified downstream greenhouse gas emissions as a proxy for assessing climate change effects. As part of this new effort, BOEM has also quantified the production, and downstream emissions from already issued leases. CEQ regulations or the new guidance from CEQ do not expressly require the monetization of cost and benefits. Despite this, BOEM has estimated the social cost of carbon in a separate technical report (available at www.boem.gov), and then summarized and referenced that broader analysis, as appropriate, in the PEIS or other Program documents.
573	Sarah Chasis, Natural Resources Defense Council	The Draft PEIS fails to sufficiently or accurately evaluate the potential impacts of oil spills to marine mammals. Section 4.4.4.5 discusses the potential impacts of oil spills per resource area, providing only a high level summary.	The level of analysis in the PEIS is in compliance with recent CEQ guidance on programmatic reviews (CEQ 2014) and is an appropriate level of detail for the decision at hand. The analysis is at a national level, and the scope of impacts is described broadly, providing geographic specificity as appropriate. If a decision is made to move forward with any of the proposed lease sales in the Proposed Five Year Program, additional reviews will take place that will be more site-specific and will analyze impacts in greater detail. Subsequent incremental NEPA documents will be written at the individual lease sale level.

Comment ID	Commenter	Comment	Response
574	Sarah Chasis, Natural Resources Defense Council	The Draft PEIS is particularly deficient with respect to the analysis of the effects of oil spills on polar bears.	The level of analysis in the PEIS is in compliance with recent CEQ guidance on programmatic reviews (CEQ 2014) and is an appropriate level of detail for the decision at hand. The analysis is at a national level, and the scope of impacts is described broadly, providing geographic specificity as appropriate. If a decision is made to move forward with any of the proposed lease sales in the Proposed Five Year Program, additional reviews will take place that will be more site-specific and will analyze impacts in greater detail. Subsequent incremental NEPA documents will be written at the individual lease sale level.
575	Sarah Chasis, Natural Resources Defense Council	The Draft PEIS fails to sufficiently analyze the direct, indirect, and cumulative effects of oil spill response. To the extent that BOEM assumes that an oil spill could be mitigated by the use of dispersants, the PEIS should disclose that the effectiveness of dispersants has not been established. The PEIS must also consider the impacts to the environment from the use of chemical dispersants. The Draft PEIS does not sufficiently address the enormous challenges of responding to an oil spill in the Chukchi Sea, Beaufort Sea, and Cook Inlet (Alaska) Program Areas. Absent from the Draft PEIS is any meaningful discussion of the many extreme environmental conditions that would inhibit or prevent spill cleanup in the Alaska Program Areas, or any comparison between those and the conditions present during the Deepwater Horizon spill.	Chapter 4 specifically addresses cumulative impacts with respect to potential spills. BOEM considered the fate and transport of oil, region-specific physical and environmental factors, and potential impacts for each evaluated resource. The Accidental Spills and Catastrophic Discharge Events Section, Chapter 4 cites a recent National Research Council (NRC) report, which outlines in detail the concerns and issues with oil spills and response activities in the Arctic (NRC 2014). Concerns associated with dispersants are recognized by BOEM, and additional text has been added to the Accidental Spills and Catastrophic Discharge Events Section, Chapter 4 to address this. With the wide-ranging environments discussed in the PEIS, a discussion of dispersants efficacy would be highly speculative and not appropriate in detail to address any concerns. Site-specific response strategies and associated potential impacts would be addressed at the lease-sale stage if a sale occurs in an Alaska program area under this Program.

Comment ID	Commenter	Comment	Response
576	Sarah Chasis, Natural Resources Defense Council	The PEIS must consider a reasonable range of future energy alternatives. The PEIS analysis should reflect our nation's commitment to transition to a clean energy future. Instead of presuming that we fail to make the transition and therefore actually might need offshore oil and gas, the PEIS should lay out the course on offshore leasing that best contributes to meeting that commitment. To address the uncertainty about the nation's future energy needs and the sources of energy to meet those needs, BOEM should consider a range of scenarios to account for that uncertainty.	BOEM recognizes that the future may bring new legal, policy, technological, or other market changes that could ultimately affect U.S. demand for and supply of oil and gas. Further cuts in energy sector emissions are necessary to meet any of the emission reduction targets specified in the 2015 Paris Agreement and President Obama’s President Obama's 2050 climate goals. However, Section 18 of OCSLA does not call for the development of a national energy strategy that prescribes targets for various energy sources, or that could transition the nation from fossil fuels over the next 70 years. Rather, OCSLA calls for the Secretary to decide what areas of the OCS should be offered for oil and gas leasing and when. Therefore, the PEIS need only analyze alternatives of size, timing and location for such leasing. The No Action Alternative broadly contemplates what would happen if there were no new OCS leasing and discusses a range of possible energy substitutes to meet future demand, including conservation and renewable energy. The underlying Purpose and Need and No Action Alternative in the PEIS reflect U.S. Energy Information Administration estimates about future oil and gas demand and supply. Similarly, BOEM does not speculate how the Proposed Action or No Action Alternatives could be affected depending on how the U.S. achieved emission reduction targets. BOEM believes that the alternatives analyzed in this PEIS present a range of reasonable alternatives to meet the underlying Purpose and Need, as directed by Congress.

Comment ID	Commenter	Comment	Response
577	Sarah Chasis, Natural Resources Defense Council	Seven recent studies demonstrate that there are no technological or economic barriers to achieving 100% renewable energy, well within the 70 year timeframe of production resulting from this Program. The U.S. energy needs can be successfully met through a range of existing and potential renewable energy developments, and the PEIS should analyze this potential in detail. Moreover, the PEIS must discuss the potential gains from efficiency. Energy efficiency provides the most cost-effective and environmentally sound way of meeting the nation's energy needs and the full potential for implementing efficiency-supporting measures must be comprehensively developed in the PEIS. The PEIS must consider the role of efficiency in determining our nation's energy needs. The PEIS must also consider the potential gains from electricity generation. The PEIS must consider how solar, wind, and other renewable energy sources will meet the nation's energy needs. The PEIS must additionally consider whether clean energy alternatives to today's petroleum-based transportation system can be adopted to meet the nation's energy needs in the future. The PEIS should also consider how renewable energy development on the OCS could replace energy expected from oil and gas leasing. Finally, the PEIS must analyze whether additional OCS fossil fuel leasing would conflict with future potential OCS renewable energy. BOEM's projections for new OCS fossil fuels should be rooted in the U.S.'s other international obligations.	BOEM uses EIA projections not as predictions, but to build a scenario on which to base possible activity levels and to conduct impact analysis. There can be wide ranges in projections depending on multiple assumptions, but OCSLA specifically mandates the development of an OCS oil and gas program every five years; the PEIS is developed to disclose the potential environmental impacts associated with the activities that may occur if leasing takes place. BOEM works within statutory and policy bounds and is not directed to develop a national energy policy or a new national energy strategy such as organizations whose work revolves around the study of specific problems and suggest possible solutions with assumptions they deem appropriate. BOEM believes that the alternatives analyzed in this PEIS present a range of reasonable alternatives to meet the Purpose and Need identified in Chapter 1. The alternatives considered in this PEIS were developed based on a number of screening criteria, described in Chapter 2. One of these is whether the alternative is consistent with OCSLA; evaluations of alternatives that are inconsistent with OCSLA are not practicable nor do they represent a meaningful alternative in the context of the Purpose and Need. BOEM recognizes that advances in technology, including advances in energy efficiency, could serve to alter the mix of energy upon with the U.S. relies in the future. Renewable energy development is not yet an economic and scalable substitute for oil and gas development. The role of energy conservation and renewable energy sources in meeting the energy demands of this country continues to grow. Such sources, however, are not currently projected to replace the energy supplied by oil and gas from OCS sources over the relevant time frame. Renewable energy development is not yet an economic and scalable substitute for oil and gas development. The role of energy conservation and renewable energy sources in meeting the energy demands of this country continues to grow. Such sources, however, are not projected to replace the energy supplied by oil and gas from OCS sources over the relevant time frame.

Comment ID	Commenter	Comment	Response
578	Sarah Chasis, Natural Resources Defense Council	The alternatives are based on an arbitrary assumption that the entire area should be leased. In developing the alternatives, BOEM must propose alternatives that avoid or minimize adverse impacts or enhance the quality of the human environment. However, BOEM identifies areas for leasing in an entirely unbalanced manner. BOEM's development of alternatives does not adequately identify ways to protect the environment and arbitrarily subjects environmental values to a higher standard of proof than the potential for oil and gas development. While BOEM requires a high standard of certainty when considering the potential for environmental damage, the agency requires no certainty whatsoever in considering the potential for the discovery of oil and gas. BOEM's inconsistency in how it treats uncertainty within the confines of each alternative is arbitrary. By starting with the assumption that the entire area within any particular region will be included, BOEM's selection of alternatives runs contrary to OCSLA's requirement that the identification of areas suitable for leasing must be as precisely as possible.	OCSLA requires the Secretary to consider all 26 OCS planning areas in order to determine the size, timing, and location of potential lease sales in a Five Year Program. BOEM does not presume that all 26 OCS planning areas or any given program area should be leased. The Draft Proposed Program and Proposed Program explain how the Secretary balanced Section 18 factors to determine the range of program areas under consideration, as well as the size and timing of potential lease sales in the remaining program areas. The PEIS identifies a reasonable range of alternatives that avoid or minimize effects, either through the exclusion of Environmentally Important Areas or outright no leasing in a program area. The PEIS takes a landscape level view of the areas that may be offered for lease to identify ways to reduce or avoid impacts. However, decisions at the programmatic level do not represent an irreversible or irretrievable commitment of resources; rather the PEIS sets the stage for subsequent environmental analyses that further evaluate the potential impacts of leasing activities and introduce additional mitigation measures as warranted.
579	Sarah Chasis, Natural Resources Defense Council	The PEIS should include alternatives that withdraw the Atlantic and Arctic under Section 12(a) of OCSLA. The PEIS should develop and recommend options for the President to use his executive power under Section 12(a) to permanently withdraw the areas from any future eligibility for oil and gas leasing. Because the best available science demonstrates any additional offshore oil and gas development in the Arctic is incompatible with our nation's climate change commitments, these areas should be permanently withdrawn from leasing. The best available science also demonstrates that oil spills cannot be cleaned up in the Arctic, and that oil can travel for thousands of miles across the region, should a spill occur.	The Secretary of the Interior eliminated the Atlantic Program Area in the Proposed Program. Section 12 of OCSLA could be used by the President to withdraw an OCS area at any time the President believes it is prudent. Although evaluation in the PEIS is not necessary to support withdrawal of an OCS area under Section 12 of OCSLA, Alternatives C and D in the Final PEIS consider no leasing in one or both of the Beaufort Sea and Chukchi Sea Program Areas under the 2017-2022 Program. This PEIS is being prepared to support the Secretary's decision about which areas of the OCS to consider for leasing during the 2017-2022 OCS Oil and Gas Leasing Program. The Secretary will consider and balance all Section 18 factors before deciding whether it is appropriate to include an Arctic lease sale in the Proposed Final Program.
580	Sarah Chasis, Natural Resources Defense Council	Given the large environmental footprint of seismic exploration and the cumulative stressors already operating on this beluga population and the minimal amounts of fossil fuel resources, the PEIS should not include an alternative for leasing in Cook Inlet.	BOEM recognizes the ongoing activities in Cook Inlet and has considered the potential cumulative effects to marine mammals. In addition, Alternative B considers exclusion of the portions of designated critical habitat for the Cook Inlet DPS of beluga whale that overlap with the program area from consideration for leasing. Alternatives C and D in the Final PEIS consider no leasing in the Cook Inlet.

Comment ID	Commenter	Comment	Response
581	Sarah Chasis, Natural Resources Defense Council	The Draft PEIS declines to consider an alternative that defers leasing until regulatory reforms (from the National Commission and other expert bodies) are in place, pointing out that regulations, technologies, safety standards, and industry practices, are continually evolving. This explanation fails to acknowledge that a certain level of safety should be reached before activity take place at all.	BOEM and BSEE continue to pursue regulatory reform and improved standards and practices, exemplified through the recent Artic Exploratory Drilling Rule.* Delaying leasing until all regulatory reform comports with the recommendation of the National Commission and other expert bodies is not technically practicable or economically feasible. The assumption that postponing leases will ultimately result in reduced activity levels and thereby potential effects in a relevant time frame is largely flawed as most activity in the near term will occur under existing leases, not under the 2017-2022 Program. The Secretary maintains the discretion to delay and/or cancel any lease sales in any OCS planning areas that are part of an approved program if prudent. The concept and possibility of delaying lease sales is implicit in the alternatives considered in this programmatic EIS. *The full title for the Rule is: Oil and Gas and Sulfur Operations on the Outer Continental Shelf—Requirements for Exploratory Drilling on the Arctic Outer Continental Shelf; Final Rule (81 FR 46478).
582	Sarah Chasis, Natural Resources Defense Council	The Draft Economic Analysis Methodology (EAM) report outlines risk reduction measures since the BP blowout, but BOEM failed to provide any analysis of how the measures have actually reduced the risk of a blowout. The EAM report outlines regulatory initiatives, including Drilling Safety Rule, the Workplace Safety Rule, the Blowout Preventer Systems and Well Control Rule, the Arctic Exploration Rule, and increased inspection and compliance efforts. All of these regulatory efforts are inadequate to provide any assurance that the risk of a blowout has decreased.	BOEM's Economic Analysis Methodology Report explains the net benefits analysis prepared as part of the OCSLA Section 18 analysis. Consistent with 40 CFR 1502.23, the PEIS incorporates by reference the net benefits analysis. This comment targets other information provided in the Economic Analysis Methodology Report that is not specifically included or required in the PEIS. Limited studies are available to quantify the actual risk reduction of recent regulatory reforms; however, the regulatory and related reform initiatives were benchmarked with that purpose in mind and target facets of operation where risk is introduced and can be better managed. While BOEM and BSEE have implemented regulatory measures to reduce the risk of loss of well control, the PEIS acknowledges that a catastrophic discharge event (CDE) is still possible. Consistent with the requirements of 40 CFR 1502.22, the PEIS analyzes the potential effects of any oil spill even if the potential is low, such as with a CDE.

Comment ID	Commenter	Comment	Response
583	Sarah Chasis, Natural Resources Defense Council	The Energy Agency Information's (EIA) reference case is an irrational model on which to base long term fossil fuel production decisions. The EIA reference case cannot support BOEM's assumptions about the need for OCS oil and gas over the next 70 years because it only forecasts energy needs until 2040. This projection is incompatible with the Paris Agreement obligation to stay well under 2 °C and to seek ways to keep warming to 1.5 °C. To the extent that BOEM relies on this baseline energy forecast to support the agency's overarching assumption about the need for a new OCS Program, the agency's reliance on EIA's projection is also irrational. BOEM is basing its proposed Five Year Program on a baseline energy forecast that runs completely contrary to the national and international imperative to limit emissions and carbon consumption drastically. The Draft PEIS provides no rational explanation as to why the EIA reference case is the only scenario considered. The Draft PEIS provides no examination of how the U.S. can meet its remaining overall emissions budget if emissions from this new OCS leasing alone will constitute more than a third of that budget. In addition, if, as the Draft PEIS assumes, the U.S. government or other governments implement no new climate policies, the remaining carbon budget will be exhausted by 2034. The PEIS should therefore explain how this or any future OCS Program based on the EIA reference case scenario can reasonably meet the nation's energy needs, when the limits for CO_2 emissions will be reached even before production on most of those leases even begins.	BOEM has revised the discussion on climate change in the PEIS to address emission reduction targets. BOEM addresses the Intended Nationally Determined Contributions (INDCs) that the U.S. delegation submitted to the United Nation under the Paris Agreement's framework. In addition, the new emissions estimates, which include downstream emissions are compared to both goals submitted to the UN for 2020 and 2025, as well as the longer-term goal by the Obama Administration to reach an 83% reduction by 2050. BOEM has not modeled the actual demand or supply changes, or possible pathways, which could be necessary to achieve the targets. BOEM has not separately modeled future demand or corresponding consumption levels that would correspond to emission-reductions targets 70 years from now as that is outside the scope of this PEIS. Section 18 of OCSLA directs the preparation of a Five Year Program to meet the potential future energy needs of the Nation. The U.S. INDC scenario does not assume “zero” oil and gas production or consumption in the future, but declining rather emissions from oil. The U.S. has made notable progress towards its 2025 emissions reduction target through measures identified in the President’s Climate Action Plan. BOEM continues to work within the organizing principal of OCSLA which directs, subject to environmental safeguards, the expeditious development of OCS resources. BOEM's analysis is predicated on existing laws and policies and uses the authoritative estimates of energy demand from the U.S. Department of Energy, Energy Information Administration (EIA) reference case. BOEM does not incorporate the World Energy Outlook or Conference of the Parties 21 “New Policies,” “Bridge,” “INDC,” or “450” scenarios. The 2017-2022 Program only proposes a schedule of potential oil and gas lease sales consistent with the requirements of OCSLA; a given program decision does not make an irretrievable commitment to hold the sales and does not guarantee oil and gas production or downstream consumption. Because of the protracted time frame (approximately 70 years) under consideration, it is even possible that production may not occur or could be greatly reduced at some point in the future given new laws or policies, or technologies or alternative sources of energy.

Comment ID	Commenter	Comment	Response
584	Sarah Chasis, Natural Resources Defense Council	The Draft PEIS dismisses renewable energy as a substitute for oil and gas, claiming that development of renewable energy sources is strategically important, but the development of these resources in the foreseeable future does not fully or partially satisfy the Purpose and Need for the Proposed Action. This replacement of oil and gas with renewable energy is supported by the projections developed by the International Renewable Energy Agency (IRENA). As BOEM acknowledges, IRENA found that the United States could reach a 27% renewable energy share by 2030 if the realizable potential of all the analyzed renewable energy technologies is implemented. However, the PEIS provides no explanation as to why it fails to consider an alternative that incorporates or is based on information from IRENA or other models.	OCSLA specifically mandates the development of an OCS oil and gas program every five years; the PEIS is being developed to disclose the potential environmental impacts associated with the activities that may occur if leasing takes place. BOEM works within statutory and policy bounds and is not directed to develop a national energy policy or a new national energy strategy. BOEM believes that the alternatives analyzed in this PEIS present a range of reasonable alternatives to meet the Purpose and Need identified in Chapter 1. The alternatives considered in this PEIS were developed based on a number of screening criteria, described in Chapter 2. One of these is whether the alternative is consistent with OCSLA; evaluation of alternatives that are inconsistent with OCSLA are not practicable nor do they represent a meaningful alternative in the context of the Proposed Action. BOEM recognizes that advances in technology, including advances in energy efficiency, could serve to alter the mix of energy upon with the U.S. relies in the future. Renewable energy development is not yet an economic and scalable substitute for oil and gas development. The role of energy conservation and renewable energy sources in meeting the energy demands of this country continues to grow. Such sources, however, are not projected to replace the energy supplied by oil and gas from OCS sources over the relevant time frame.
585	Sarah Chasis, Natural Resources Defense Council	The general approach to environmental assessment in the Draft PEIS is flawed. The Draft PEIS continues the systemic breakdown of the environmental review process for OCS activities identified by the National Commission, wherein detailed analysis is deferred to a later stage. A comprehensive and systematic analysis of impacts is necessary at the programmatic level not only to ensure that subsequent, site-specific analyses are sufficient, but also to ensure that a full picture of impacts is available for the Secretary to conduct a proper balancing of environmental concerns. The Draft PEIS is devoid of an adequate impacts analysis. The Draft PEIS lists impact producing factors and outlines moderate to major impacts that could occur as a result of each of these impact producing factors, without regard to whether these impacts would be different in different locations. In addition, the PEIS generalizes impacts to broad categories of resources, such as birds and marine mammals. This skeletal, over-broad, listing of resources and impacts does not meet the requirements of NEPA. Additionally, the analysis fails to provide conclusions regarding whether the impacts are significant.	The analytical approach in the PEIS is consistent with CEQ's guidance on "Effective Use of Programmatic NEPA Reviews." Impact analyses are broad and focused on potentially significant impacts consequential to the decision being made, focusing on impacts that may be moderate to major. The discussion of impacts allows the decisionmaker to take a hard look at potential effects and make a reasoned choice among alternatives considered. The level of detail and depth of impact analysis provide a broad geographic and temporal context; additional detail at the species level is provided in the environmental document prepared at the lease sale stage. Finally, NEPA's significance threshold is of most importance when deciding how to analyze a Proposed Action. In the case of the Five Year Program, BOEM determined that significant impacts could occur to various resource areas. Therefore, an environmental impact statement was prepared instead of an environmental assessment to address that potential.

Comment ID	Commenter	Comment	Response
586	Sarah Chasis, Natural Resources Defense Council	The Draft PEIS fails to include an assessment of whether activities conducted under the Program would comply with the mandates of applicable laws including OCSLA, the ESA, and the MMPA.	Appendix J describes applicable laws relevant to the implementation of a Five Year Program. BOEM ensures compliance with all relevant environmental laws and regulations, including with consultation requirements, at subsequent stages including the lease sale or plan stage.
587	Sarah Chasis, Natural Resources Defense Council	The Net Benefits analysis incorporated by reference into the Draft PEIS improperly excludes catastrophic spills. The Net Benefits analysis of the potential impacts and costs of oil spills is incomplete because it does not include the monetized impacts from catastrophic spills. Second, the PEIS indicates that the costs of catastrophic spills are not included in the Net Benefits analysis because they are not quantified. This is incorrect. The costs of catastrophic spills are quantified separately in the Economic Analysis Methodology report. As quantifiable costs, they should have been included in the Net Benefits analysis. Third, the PEIS states that the costs of catastrophic spills are not included because they are not reasonably foreseeable. However, the D.C. Circuit Court of Appeals has recognized that section 1502.22(b) of CEQ's regulations clarifies that reasonably foreseeable effects include impacts which have catastrophic consequences, even if their probability of occurrence is low. The PEIS excludes the impacts of catastrophic spills from the Net Benefits analysis because the SIMAP model it relies on to predict the fate of spilled oil is only able to analyze smaller surface releases. However, the PEIS must rely on the best existing information available. Other computer models capable of analyzing the trajectories of catastrophic spills exist and are available. The PEIS cannot rely on inferior modeling technologies when more accurate and comprehensive models exist and are available. The PEIS provides no appropriate basis for excluding the potential costs of catastrophic spills from the Net Benefits analysis. The Net Benefits analysis should be reevaluated with these costs included. The Net Benefits analysis does not appear to account for the cost of additional, necessary Alaska area infrastructure. The Net Economic Value (NEV) calculation does not include the billions of dollars in oil spill response infrastructure that would need to be spent if leasing were to occur in the Alaska Program Areas, or that would be saved under a No Sale Option for those areas.	The PEIS satisfies the broader requirement found at 40 CFR 1502.23 to incorporate by reference the cost-benefit analysis given one was prepared and it was determined to be relevant to a choice among environmentally different alternatives. The CEQ regulations do not prescribe the approach or methods necessary for a cost-benefit analysis. In its Economic Analysis Methodology report, BOEM explains why the potential costs of a catastrophic spill are not included in the net benefits analysis. In comparison, the PEIS address the catastrophic effects of spill if one were to occur consistent with 40 CFR 1502.22. The effects of a catastrophic spill are reasonably foreseeable if the spill occurs; however, such a spill may not be reasonably foreseeable or probable for that matter. The costs of such a spill are not included in the net benefit analysis because the spill is not expected to occur with the same likelihood as other benefit and cost factors considered in the analysis. Nonetheless, BOEM has quantified those costs in the case it does occur and these costs are provided in the Economic Analysis Methodology report.

Comment ID	Commenter	Comment	Response
588	Sarah Chasis, Natural Resources Defense Council	The PEIS fails to analyze the direct, indirect, and cumulative impact of fossil fuels developed as a result of the Five Year Program. The Five Year Program assumes that 4-20 billion barrels of oil equivalent could be produced from the areas considered for lease. Yet, the PEIS ignores any impacts that would result from the burning of these fossil fuels. The PEIS should discuss how the Proposed Program will contribute to or interfere with national, state and local climate and energy policies. The PEIS should describe not only the downstream effects of the Five Year Program, but also quantify those effects, using the social cost of carbon.	On August 1, 2016, the Council on Environmental Quality issued Final Guidance for the Consideration of Greenhouse Gas Emissions and the Effects of Climate Change in National Environmental Policy Act Reviews. The Final PEIS addresses the effects of climate change consistent with that guidance, including describing the sensitivity of resources to future impacts because of a changing climate. BOEM has prepared a new technical report that quantifies the potential downstream greenhouse gas emissions and the social cost of carbon associated with ongoing OCS Program and 2017-2022 Program oil and gas activities and consumption of oil and gas produced on the OCS. The technical report is referenced and summarized in the PEIS and other relevant Program documents. The social cost of carbon is not incorporated into the net benefits analysis for the reasons described in the Economic Methodology report and Proposed Final Program. The PEIS discloses the relationship between that net benefits analysis and separate social cost of carbon analysis. Both reports are available at www.boem.gov.
247	Shari Wilson, United States Environmental Protection Agency	Draft PEIS Page 4-4, Line 10-11: Incorrect description. The correct sentence should be: One ton of CH_4 is estimated to have the same warming potential as 25 tons of CO_2, and for N_2O, 298 tons. (The original used "molecules" rather than "tons").	Text has been revised per comment.
248	Shari Wilson, United States Environmental Protection Agency	Draft PEIS Page 4-96, Line 3: The reference to tables (Tables 9.1-1, 9.1-2, 9.2-1 and 9.3-1) do not correspond to the tables listed in Appendix C. Please correct.	Areas of Special Concern does not appear as a separate resource in the Final PEIS therefore no edits are necessary.
249	Shari Wilson, United States Environmental Protection Agency	Draft PEIS Page C-17: Line 20/Line 29: Duplicate paragraph, delete redundant one.	Text has been revised per comment.
250	Shari Wilson, United States Environmental Protection Agency	Draft PEIS Page C-18, Lines, 7, 10, Page C-21, Line 10: Celsius to Fahrenheit conversion done incorrectly: a change of 1.1 degrees C is a change of 2 degrees F, not 34 degrees F.	Calculations have been revised. Text has been moved to Chapter 4, Climate Change.

Comment ID	Commenter	Comment	Response
251	Shari Wilson, United States Environmental Protection Agency	Draft PEIS Page 3-7, Line 35: Please clarify if plans exist to utilize infrastructure in the community of Wainwright for Chukchi development.	The level of detail presented regarding infrastructure is appropriate for a programmatic EIS. Location of specific shorebases or other infrastructure usage in particular towns and villages will be discussed in lease-sale or project-specific NEPA documents prepared and/or reviewed by BOEM.
252	Shari Wilson, United States Environmental Protection Agency	Draft PEIS Page 4-3, Line 27: delete "also known as natural gas."	Text has been revised per comment.
253	Shari Wilson, United States Environmental Protection Agency	Draft PEIS Page 4-3, Line 34: CH_4 is emitted (in relatively small quantities) from combustion of fossil fuels. In addition, because CH_4 is emitted from combustion, and from venting/leaks/flaring at offshore platforms, USEPA suggests changing the sentences here, see below. Delete these sentences from pg. 4-3 line 34: CH_4, unlike other climate forcers, is not introduced through combustion of fossil fuels. Instead CH_4 is removed from the well and brought onto OCS facilities along with oil being produced. Replace with this sentence: Methane is also released, as a fugitive, (so called because it can escape unintentionally from leaks in equipment used by operators), through venting, and through incomplete combustion. Delete this sentence pg. 4-4 line 1: Methane is also released as a fugitive, so called because it can escape unintentionally from leaks in equipment used by operators.	Text has been revised per comment.
254	Shari Wilson, United States Environmental Protection Agency	Draft PEIS Page 4-6, Line 7: The statement is "climate change is expected to increase the amount of vegetation". Instead, USEPA recommends stating "CO_2 fertilization is expected to increase the amount of vegetation" because climate change has mixed effects depending on location.	Text has been revised per comment.
255	Shari Wilson, United States Environmental Protection Agency	Draft PEIS Page B-19/B-24/etc.: For various regions, climate change is listed as leading to an "increase in precipitation rate". Instead, USEPA recommends, "change in precipitation rate" as in some regions, there will be a decrease.	Text has been revised per comment.

Comment ID	Commenter	Comment	Response
256	Shari Wilson, United States Environmental Protection Agency	Draft PEIS Page C-19, Line 18-19: 0.6 m (2ft) by 2100 is actually a conservative estimate of future sea level rise, and so the phrase "Predictions in SLR are as much as 0.6m" would be misleading: later in the chapter, several other numbers are presented that better represent the projected range (e.g., 0.3 to 1.2 m in Table C-1).	Text has been revised per comment.
257	Shari Wilson, United States Environmental Protection Agency	Quantification of CH_4 tables pg. 4-5. On the quantification piece, USEPA was unable to find information on how the emissions were quantified. For clarification, USEPA suggests BOEM include answers to the following questions: How many platforms were included? Were GOADS data used? How were GWPs applied? Chapter 4 suggested that it may have been on a per molecule basis and not a per ton basis, which would be incorrect.	Text has been revised per comment.
258	Shari Wilson, United States Environmental Protection Agency	Draft PEIS Page xiii, Line 11: change 2012 to 2022. Line 42: recommend adding 40 CFR parts 1500-1508.	Text has been revised per comment.

Comment ID	Commenter	Comment	Response
275	Sierra Weaver, Southern Environmental Law Center	To successfully apply a landscape-scale strategy to its oil and gas activities on the Outer Continental Shelf (OCS), BOEM should ensure that the following guidelines are followed: 1) Application of the mitigation hierarchy should be based on an identification of “the needs and baseline conditions of targeted resources and their values, services and functions, reasonably foreseeable impacts, cumulative impacts of past and likely projected disturbance to those resources, and future disturbance trends” (DM §6.4(E)). BOEM should ensure that it uses robust, comprehensive ecological baseline data in which ecologically significant places are identified for a given landscape or region like the Mid- and South Atlantic Planning Area. BOEM should use an equally thorough inventory of existing and future cumulative impacts based on spatial and temporal patterns of human uses in the ocean for each OCS project area. 2) The landscape-scale approach should then use “such information to identify priorities for avoidance, minimization, and compensatory mitigation measures across that relevant area to provide the maximum benefit to the impacted resources and their values, services, and functions, with full consideration of the conditions of additionality and durability” (DM §6.4(E)) 3) These data should also be used to identify resources that are of such “irreplaceable character that minimization and compensation measures, while potentially practicable, may not be adequate or appropriate, and therefore” should be avoided altogether (PM §1).	Following the approval of the 2017-2022 Program, BOEM will consider and, where appropriate, employ additional mitigation (including the full hierarchy of avoidance, minimization, and compensation) in the later stages of the oil and gas development process under OCSLA. Appropriately scaled analyses at these later decisions for leasing, exploration, development, and production can best identify specific mitigation measures, including required compensatory mitigation measures.

Comment ID	Commenter	Comment	Response
276	Sierra Weaver, Southern Environmental Law Center	The Draft PEIS, however, "assumes that BSEE will implement requirements for safe operations and environmental protection, including requiring the use of the best technologies and operational practices." In reference to BSEE compliance monitoring specifically, the Draft PEIS briefly states that "BSEE [...] monitors operations after drilling has begun and carries out periodic inspections of facilities [...] to ensure safe and clean operations over the life of leases." Because the environmental impacts of offshore oil and gas activities will depend in large part on oversight and compliance monitoring by BSEE, and because BSEE has already proven that it is not carrying out compliance monitoring as intended, BOEM should not assume that BSEE will in fact implement requirements for safe operations and environmental protection in the Draft PEIS. To the extent that staff shortages and a lack of other resources exist, the Final PEIS should indicate any shortcomings in environmental compliance monitoring that could contribute to unsafe conditions and negative environmental impacts.	The issue of regulatory and safety procedures is briefly discussed in several sections of the PEIS to provide a broad overview within a programmatic context (see Section 1.3, Appendix I and Appendix J). Accidental spills and catastrophic discharge events are also addressed in Chapter 4, Impact Assessment Section. This discussion summarizes spill statistics, oil spill fate, and impacts to various resource categories all within a programmatic context. The role of BSEE, its regulatory compliance responsibilities, the shortcomings in regulatory oversight identified in the GAO 2016 report, and implemented or planned remedies will be evaluated and summarized in future lease sale EISs.
277	Sierra Weaver, Southern Environmental Law Center	We respectfully disagree with the statement in the Draft PEIS that a catastrophic spill is not expected in part due to "the comprehensive reforms to offshore oil and gas regulation and oversight put in place after the Deepwater Horizon event." This assessment, citing a BSEE fact sheet on the Bureau's "aggressive and comprehensive reforms," is in sharp contrast to the GAO report, which found BSEE's reforms to be seriously deficient. A thorough NEPA analysis must address the concerns raised in the GAO report and the shortcomings in regulation and oversight that could contribute to unsafe conditions and negative environmental impacts.	Accidental spills and catastrophic discharge events are also addressed in Chapter 4. This discussion summarizes spill statistics, oil spill fate, and impacts to various resource categories all within a programmatic context. The role of BSEE, its regulatory compliance responsibilities, the shortcomings in regulatory oversight identified in the GAO 2016 report, and implemented or planned remedies will be evaluated and summarized in future lease sale EISs.
278	Sierra Weaver, Southern Environmental Law Center	It is important to note that the greenhouse gas emissions noted above result from OCS activities that take place pursuant to the leasing program. BOEM should also carefully assess emissions that will occur from the burning of oil and gas extracted from offshore areas, and to consider how those "downstream" emissions will impede the nation's ability to meet its climate obligations. According to BOEM Director Abigail Hopper, BOEM is "having an ongoing conversation [...] about whether it's appropriate to think about and consider those downstream emissions." Acknowledging all emissions impacts from the oil and gas leasing program is essential to a responsible U.S. climate policy, and the actual consumption of oil and gas generated by the leasing program should be a key consideration in the agency's decisionmaking process.	On August 1, 2016, CEQ issued Final Guidance for the Consideration of Greenhouse Gas Emissions and the Effects of Climate Change in National Environmental Policy Act Reviews. The Final PEIS addresses the effects of climate change consistent with that guidance, including describing the sensitivity of resources to future impacts because of changing climate. BOEM has also quantified downstream greenhouse gas emissions as a proxy for assessing climate change effects.

Comment ID	Commenter	Comment	Response
279	Sierra Weaver, Southern Environmental Law Center	BOEM should also carefully assess emissions that will occur from the burning of oil and gas extracted from offshore areas, and to consider how those 'downstream' emissions will impede the nation's ability to meet its climate obligations. BOEM should further assess the impacts of the entire 2017-2022 leasing program, in addition to the impacts of the consumption of oil and gas extracted under the program, on global climate change and take into account the United States' responsibility and global commitment to reduce greenhouse gas emissions.	On August 1, 2016, CEQ issued Final Guidance for the Consideration of Greenhouse Gas Emissions and the Effects of Climate Change in National Environmental Policy Act Reviews. The Final PEIS addresses the effects of climate change consistent with that guidance, including describing the sensitivity of resources to future impacts because of changing climate. BOEM has also quantified downstream greenhouse gas emissions as a proxy for assessing climate change effects.
280	Sierra Weaver, Southern Environmental Law Center	Missing from BOEM's analysis, however, is any mention of the air quality impacts resulting from expanded onshore oil and gas infrastructure and the burning of oil and gas extracted under the program.	The level of analysis presented is appropriate for a PEIS. More detailed site-specific assessments of impacts on air quality will be included in regional-, lease-, or activity-specific NEPA documents prepared by BOEM. The PEIS-level discussion of air quality impacts from oil and gas operations associated with the Proposed Action are presented in the Air Quality Section of Chapter 4. Consumption of potential oil and gas extracted under the Proposed Action are out of scope for the PEIS.
281	Sierra Weaver, Southern Environmental Law Center	The submission (pg. 21) suggests that the impacts to benthic communities will be more severe than reported in the PEIS. Specifically, the submission suggests that BOEM did not acknowledge the impacts of noise from seismic activities on Marine Benthic Communities. Literature provided.	Acoustic impacts on fish (including benthic habitat) and fishery management areas such as EFHs, HAPCs, and MPAs are discussed in the Fish and EFH Section of the PEIS. Moderate or major acoustic impacts from oil and gas related sources to benthic invertebrates is not expected and has not been documented; therefore this is not discussed in the Marine Benthic Communities Section of the PEIS. Appendix E includes discussion of acoustic impacts to benthic invertebrates.
283	Sierra Weaver, Southern Environmental Law Center	The Draft PEIS indicates that the only expected impacts on fish and fish habitat from leasing, exploration, and development activities will result from routine and non-routine oil spills, and only moderate impacts on fish and fish habitat are expected from these spills. In addition, only minor to moderate cumulative impacts are expected to fish and EFH. BOEM's findings of moderate impacts are adequately supported in the Draft PEIS, however, we believe the scope of expected impacts is broader and includes impacts from noise, routine discharges, bottom/land disturbance, and space-use conflicts.	The level of analysis in the PEIS is in compliance with recent CEQ guidance on programmatic reviews (CEQ 2014) and is an appropriate level of detail for the decision at hand. The analysis is at a national level, and the scope of impacts is described broadly. If a decision is made to move forward with any of the proposed lease sales in the Proposed Five Year Program, additional reviews will take place that will be more site-specific and will analyze impacts on ESA listed and non-listed species in greater detail. Subsequent incremental NEPA documents will be written at the individual lease sale level.

Comment ID	Commenter	Comment	Response
284	Sierra Weaver, Southern Environmental Law Center	Pages 4-8 of the comment provide an expanse of literature regarding the Deepwater Horizon accident. In summary, the commenter is suggesting that the oil spill impact analysis section, specifically a CDE, impact analysis is not sufficiently evaluated.	Chapter 4 discusses and evaluates potential accidental spills and catastrophic discharge events as a result of the Proposed Action. Evaluations included consideration of fate and transport of oil, region-specific physical and environmental factors, and potential impacts for each evaluated resource. Potential impacts from accidental spills and unexpected catastrophic discharge events (CDEs) for each resource were given a rating ranging from negligible to major based on the evaluation. The Deepwater Horizon event is considered a CDE and CDE impacts have been evaluated at a programmatic level in the PEIS. Deepwater Horizon effects were also considered as part of the baseline conditions in the Gulf of Mexico. A more detailed analysis of a potential CDE and impacts are included in NEPA analyses at the regional and lease sale stage of the leasing process.
56	Stefan Milkowski	However, the Draft PEIS completely omits consideration of the much greater climate-related impacts of the consumption of any fossil fuels produced from offshore leases. It is irresponsible and incorrect for the PEIS to exclude such a major impact. The greenhouse gas emissions associated with the use of fossil fuels produced in the Arctic is globally significant. The impact of burning even a fraction of the oil developed through a lease resulting from the proposed plan will create climate-related impacts many times as severe as those considered in the PEIS. These impacts will both have direct effects on the human environment and Arctic ecosystems, and will in turn exacerbate risks faced by companies producing oil offshore. Therefore, the PEIS should also consider the increased risks associated with more frequent and severe storms over the period of leasing and production, as well as the cumulative impacts to plant and animal species already threatened by climate-related changes. Specifically, the PEIS should include consideration of new studies related to the fugitive methane emissions associated with oil and gas production and distribution (Turner, Jacob, et al., 2016, Geophysical Research Letters), the new Nature study related to projected sea level rise associated with climate change (DeConto and Pollard, 2016), and the Nature letter analyzing global fossil fuel production in light of global commitments to limiting warming to 2 degrees Celsius (McGlade and Ekins, 2015).	BOEM has expanded the climate change analysis to include downstream consumption of oil and gas in the Final PEIS. Additionally, in the Final PEIS, BOEM has expanded relevant resource sections to ensure information is included on how the impacts of the Proposed Action could be further complicated due to climate change. The expanded information on climate change includes information from McGlade and Ekins. Although Turner, Jacob, et al., 2016 discusses national methane emissions, the paper does not discuss, or quantify specifically the emissions from operations offshore. BOEM is currently preparing a study focused specifically on fugitive emissions from offshore facilities. This study is expected to be completed by 2018. The overall expansion of climate change includes more information on methane emissions. BOEM includes fugitive emissions from engines and other equipment. The DeConto and Pollard, 2016 paper's analysis on sea level rise as a result of Antarctic melting is more specific than the citation we use from Intergovernmental Panel on Climate Change which discusses sea level rise collectively from worldwide glaciers and ice caps, which better addresses the discussion needed in the PEIS.

Comment ID	Commenter	Comment	Response
488	Susan Prevost	What would help me trust BOEM and the entire process of energy renewal and resources is transparency in ordinary language concerning regulatory and safety procedures of oil leases if that is the conclusion, in the end.	The issue of regulatory and safety procedures is briefly discussed in several sections of the PEIS to provide a broad overview within a programmatic context (see Section 1.3, Appendix I and Appendix J). It is noteworthy that the PEIS, as a programmatic document, provides a broad analysis of the projected levels of exploration, development, production, and decommissioning activities which result from leasing during the 2017-2022 period. Further, more detailed analysis of site-specific issues and impacts, including those addressing regulatory compliance and safety, will be conducted in future lease sale EISs and specific project plans. The following link provides additional detail on regulatory and safety reform undertaken by BOEM and BSEE as well: http://www.bsee.gov/BSEE-Newsroom/Press-Releases/2016/Interior-Department-Releases-Final-Well-Control-Regulations-to-Ensure-Safe-and-Responsible-Offshore-Oil-and-Gas-Development/
489	Susan Prevost	We need more comprehensive understanding of the structure/function of an oil well and what exactly goes into its use.	Detailed information on oil and gas exploration equipment and materials are discussed in the focused, site-specific documents associated with exploration, development, or production plans. For this programmatic document, the focus is a broad analysis of possible impacts associated with implementing a five year leasing program.
104	Teresa Imm, Arctic Iñupiat Offshore, LLC	Arctic Iñupiat Offshore, LLC (AIO) respectfully requests that BOEM schedule additional public meetings within the communities of the North Slope Borough (NSB), Alaska and extend the comment period by at least 30 days to allow AIO and other key North Slope stakeholders to conduct their review and prepare comments for the Draft Programmatic Environmental Impact Statement (PEIS) on the Outer Continental Shelf (OCS) Oil & Gas Leasing Program: 2017-2022. The level of review required cannot be completed in the 45-day comment period on the Draft Programmatic EIS; therefore, AIO requests the BOEM extend the comment period 30 days to provide opportunity for the development of thoughtful comments. AIO requests that BOEM conduct additional public meetings in Kaktovik, Barrow, Nuiqsut, Point Lay, Point Hope, and Wainwright to more meaningfully consult with AIO, North Slope residents, and other key stakeholder groups.	On March 18, 2016, BOEM published a Notice of Availability of the Draft PEIS for the 2017-2022 Oil and Gas Leasing Program. NEPA requires a minimum 45-day comment period on Draft PEIS documents, a period which may be extended at the discretion of the agency issuing the document. In the case of the Five Year Draft PEIS, BOEM determined that 45 days was adequate and appropriate for a programmatic document. However, all stakeholders were encouraged to provide comments on the 2017-2022 Proposed Program during the comment period, which ended June 16, 2016. BOEM recognizes the importance of input from public stakeholders, and appreciates the timing constraints noted by the commenter.

Comment ID	Commenter	Comment	Response
302	Teresa Imm, Arctic Iñupiat Offshore, LLC	AIO is abundantly aware of the volume of traditional knowledge and western science which support exploration and development of the Arctic OCS. AIO is confident that as BOEM continues their analysis they will recognize the abundance of data and traditional knowledge that supports continued operations in the Arctic OCS. It is disheartening the lack of traditional knowledge incorporated in the PEIS. Traditional knowledge is an essential piece of successful operations on the North Slope and in the OCS. When incorporated into Arctic oil and gas development projects and into the assessment of these projects, it can improve operating practices, safety protocols, marine mammal protection, and emergency and environmental response systems. AIO encourages BOEM to investigate the breadth of this data which we have included for BOEM's convenience. AIO encourages BOEM to incorporate the NEPA reviews, traditional knowledge, and ongoing research in their PEIS which AIO has attached to this letter.	While the high level overview inherent in a national programmatic document does not lend itself to detailed descriptions of the affected environment and potential impacts, traditional knowledge (TK) is an integral part of BOEM analyses of Arctic program areas. BOEM relies on both TK and western science in identifying potential impacts to marine resources, including birds and marine mammals. This is particularly true in the Arctic, where TK has significantly informed marine mammal research. As an example, a recently completed BOEM-funded walrus tagging project relied on subsistence hunters to place tags on walrus, and to inform when and how to access animals for tagging without causing undue disturbance. This study has provided valuable information about walrus movements in the Chukchi Sea. BOEM appreciates the list of suggested resources provided by the commenter. Traditional knowledge has been incorporated in the sociocultural description of the environment in the Final PEIS from several of the resources including the Chukchi 193 Final Second Supplemental EIS and NSB documents describing TK and bowhead whales. We believe these sources encompass substantial TK, adequate for this programmatic level EIS. Also, a significant part of the sociocultural systems description of the environment is from Galginaitis, 2009.
303	Teresa Imm, Arctic Iñupiat Offshore, LLC	The current collaboration between whalers and industry, along with existing mitigation measures, provide a conduit to establish a common purpose of protecting subsistence use while accommodating industry activities. The presence of these management techniques, such as the Conflict Avoidance Agreement (CAA), Subsistence Advisers (SAs), Community Liaison Officers (CLOs), and Protected Species Observers (PSOs) are not fully characterized throughout BOEM's analysis. BOEM neglects to acknowledge that co-existence is a reality of activities in the OCS and is already occurring. AIO is confident that with tools such as the existing CAA, traditional knowledge, SAs, PSOs, and other design measures that impacts on subsistence can be mitigated or avoided. Industry has shown a history of willingness to work with the Iñupiat people and define appropriate measures to reduce impacts. AIO recognizes that the Iñupiat people and industry have tools in place to manage this coexistence successfully.	BOEM acknowledges existing measures to deconflict use of the Arctic OCS and appreciates the long history of coordination that has gone into making these efforts successful. In the Final PEIS, BOEM included analysis of development of an Alaska Conflict Management Plan as a condition of plan approval to mitigate impacts.

Comment ID	Commenter	Comment	Response
304	Teresa Imm, Arctic Iñupiat Offshore, LLC	AIO reiterates some of the conclusions from the National Petroleum Council Report: Arctic Potential about operations in the Arctic which BOEM should consider in their review. 1) NPC recommends longer lease terms in the Arctic to account for seasonal restrictions and to explore in the most efficient and safe manner. BOEM should consider this recommendation in their analysis. 2) NPC concludes that existing technology is available to conduct safe and responsible resource development in the Arctic. BOEM should fully consider this long history and the technology currently available. 3) NPC concludes that while the Arctic presents unique factors, it is widely understood and within the capacity of the industry. BOEM should fully consider the breadth of information which has been collected analyzing the Arctic and the potential impacts which have been closely mitigated and monitored.	Analyzing longer lease terms is not within the scope of this PEIS, or the Proposed Action under consideration. The length of the primary term, or initial period, of an OCS lease is established by Congress. Section 8(b) of OCSLA establishes that the maximum length of any initial period can be ten years, and only when the Secretary finds that a longer period than the minimum term of five years is necessary to encourage exploration or development in areas characterized by unusually adverse conditions. Congressional action would be necessary to change the length of lease terms in the Arctic. BOEM has reviewed the conclusions from the report and taken them into consideration.
307	Teresa Imm, Arctic Iñupiat Offshore, LLC	AIO respectfully asks that BOEM consider and include the long history of safe exploration and development in the Alaskan Arctic, both in State and Federal waters, throughout their analysis of the PEIS. AIO maintains that safe and responsible development of OCS can continue to proceed with manageable impacts and looks forward to BOEM's continued analysis. With proper respect to the traditional knowledge and western science which support existing mitigation measures, AIO is confident that BOEM will conclude that exploration of the OCS can continue with existing mitigation to reduce or avoid potential impacts.	BOEM recognizes the long history of safe operations in the Alaskan Arctic. Accidental spills and catastrophic discharge events are addressed in Chapter 4. This discussion also summarizes spill statistics, oil spill fate, and impacts to various resource categories all within a programmatic context. Further, more detailed analysis of site-specific issues and impacts, including more refined spill statistics and trajectory analyses, will be conducted in future lease sale EISs and specific project plans. The issue of regulatory and safety procedures is briefly discussed in several sections of the PEIS to provide a broad overview within a programmatic context (see Section 1.3, Appendix I and Appendix J). It is noteworthy that the PEIS, as a programmatic document, provides a broad analysis of the projected levels of exploration, development, production, and decommissioning activities which result from leasing during the 2017-2022 period. This level of projected future activity is one of the cornerstones for predicting the frequency and nature of potential accidents, including spills and catastrophic discharge events.

Comment ID	Commenter	Comment	Response
308	Teresa Imm, Arctic Iñupiat Offshore, LLC	Though the Arctic does not possess the level of infrastructure as seen in the Gulf of Mexico, AIO does not see this as a disadvantage but as an additional reason to support OCS development. An investment in the region would stimulate economic opportunity across the region and stimulate our existing infrastructure, such as the Trans-Alaskan Pipeline System (TAPS) which is currently running at 25% capacity.	The Population, Employment and Income Section (Chapter 4) addresses the potential economic, employment, and income benefits to that could be realized as a result of the Proposed Action. These estimates used BOEM's regional economic impact model (MAG-Plan) to produce the estimates of possible impacts. For additional information on the benefits and risks of the Alaska lease sales in the Proposed Program, see the Alaska OCS Region Benefits and Risks Section, of the accompanying 2017-2022 Outer Continental Shelf Oil and Gas Leasing Proposed Program Decision Document. The equitable sharing analysis includes discussions of increased wages, additional jobs, increased tax collections, and revenue sharing likely to result from the Alaska sales.
309	Teresa Imm, Arctic Iñupiat Offshore, LLC	BOEM states that with respect to acoustic impacts, "There is no set pattern to when one or another potential impact will occur." AIO encourages BOEM to analyze the abundant monitoring data which has analyzed industry activities with respect to bowheads during exploration and development operations; both Marine Mammal Mitigation and Monitoring Reports (4MPs) and ongoing data collected from Northstar could provide information to assess these impacts. Additionally, AIO notes that in Dr. Susan Blackwell et al. article, Effects of Airgun Sounds on Bowhead Whale Calling Rates: Evidence of Two Behavioral Thresholds, this very threshold is discussed based off data gathered in the Beaufort Sea Area. The results of this study indicated that two thresholds existed from which bowheads reacted, at a 97-127 dB range calling rates remained the same, and at a 127-160 dB range calling rates begin to decline until ceasing at 160 dB. This information is understood by AIO and industry operators and is utilized to adjust sound levels to mitigate impacts.	BOEM used a number of industry-participant acoustic monitoring reports as part of its analysis. In the analysis process, generalized basin-wide conditions were selected to best reflect areas where the current and predicted acoustic spectrum shows a high potential to produce impacts to marine mammals, and, how sound could propagate throughout the basin. See Appendix D for further details.

Comment ID	Commenter	Comment	Response
310	Teresa Imm, Arctic Iñupiat Offshore, LLC	AIO respectfully requests that BOEM fully consider the direct and indirect benefits from Arctic OCS development. Both the jobs and wages generated from Arctic OCS development would reverberate across the State. Whether through direct services, or through the supply chain, Arctic OCS development represents a significant employment opportunity which should be fully realized in the PEIS.	The Population, Employment and Income Section (Chapter 4) addresses the potential economic, employment, and income benefits to that could be realized as a result of the Proposed Action. These estimates used BOEM's regional economic impact model (MAG-Plan) to produce the estimates of possible impacts. The level of analysis in this chapter is appropriate for a programmatic EIS. More thorough assessments of direct and indirect economic impacts will be included in Arctic region-, lease sale-, or activity-specific NEPA documents prepared by BOEM. For additional information on the benefits and risks of the Alaska lease sales in the Proposed Program, see the Alaska OCS Region Benefits and Risks Section, of the accompanying 2017-2022 Outer Continental Shelf Oil and Gas Leasing Proposed Program Decision Document. The equitable sharing analysis includes discussions of increased wages, additional jobs, increased tax collections, and revenue sharing likely to result from the Alaska sales. It also addresses environmental risks of the program proposal, as well as those of the energy substitutes that would most likely take the place of OCS production in the absence of the proposed lease sales (No Action Alternative).
311	Teresa Imm, Arctic Iñupiat Offshore, LLC	AIO views the designations of the EIAs as overly prescriptive and not justifiable. AIO is concerned that designating these areas will seriously reduce the economic viability of future exploration programs and does not provide significant added environmental benefit. AIO maintains that with proper mitigation measures in place, traditional knowledge, and coordination with the local communities that many of the potential impacts to the Arctic OCS can be minimized or avoided throughout the OCS and in these EIAs. The economic potential of the Arctic OCS is enormous and could be a significant factor in the economic stability of the Iñupiat people and the local communities for the future.	BOEM acknowledges existing measures designed to deconflict use of the Arctic OCS and appreciates the long history of coordination that has gone into making these efforts successful. In the Final PEIS, BOEM included how development of an Alaska Conflict Management Plan as a condition of plan approval could mitigate impacts in lieu of excluding an EIA. The PEIS does not include any requirements for mitigations in EIAs. The PEIS analyzes mitigation measures up to and including exclusions of EIAs to reduce impacts. This information will be used to inform future decisions. The analyses provide information to the decisionmaker and no outcome is presumed.

Comment ID	Commenter	Comment	Response
313	Teresa Imm, Arctic Iñupiat Offshore, LLC	AIO calls to mind BOEM's own ongoing analysis through their Continuation of Arctic Nearshore Impact Monitoring in the Development Area (CANIMIDA) which evaluates potential industry disruption to the Cross Island whale hunt, among other things. AIO notes that in decades of observing potential impacts to the bowhead whale hunt, in the 2001-2007 report, observations made were consistent with AIO's statements: What has become clear from an examination of seven field seasons of data is that, at least during the period of study, there does not appear to be any clear way to test for (or demonstrate) any adverse effects of oil and gas activities on the Cross Island subsistence whaling" (Galginaitis 2008). This conclusion is supported by both Michael Galginaitis' previous and sequential observations.	BOEM acknowledges the input on the utility of the Cross Island EIA to reduce impacts to subsistence use. The area included in the Final PEIS is reduced from what was in the Draft and is designed to reflect the occurrence of biological resources and is not targeted at subsistence use, specifically.
314	Teresa Imm, Arctic Iñupiat Offshore, LLC	AIO is particularly cognizant of the potential acoustic impacts which, as BOEM assesses, have the potential to disrupt the bowhead whale migration. AIO regards this potential impact closely as any disruption to the bowhead whale migration could jeopardize the success of the subsistence hunt and have adverse impacts to the communities. AIO appreciates BOEM's close analysis of this issue and respectfully requests that BOEM consider acoustic monitoring programs from Shell, BP, and Hilcorp, which can assist in assessing these potential impacts.	BOEM values the contributions from industry monitoring programs and has been a partner in many of the cooperative efforts. As such, a large number of resulting industry monitoring reports and publications were reviewed as part of this PEIS. Specific information from these industry monitoring programs could be used to inform mitigation measures at the lease sale stage. This level of detail is not appropriate for a programmatic level analysis.

Comment ID	Commenter	Comment	Response
315	Teresa Imm, Arctic Iñupiat Offshore, LLC	AIO notes that in BOEM's analysis they evaluate sounds emitted from ice-breaking activities as well as seismic, decommissioning, and drilling activities as at-risk activities for impacting the migration. Of these, seismic and drilling activities are the most relevant for disrupting the migrations as exploration activities would occur in the open water season and would not necessitate ice-breaking activities. The existing CAA has mitigation measures already incorporated to manage potential impacts from seismic and drilling operations. Furthermore, as an outcome of the Camden Bay Science Initiative, a collaboration between industry and whalers to determine potential impacts to bowheads and potential solutions, it was determined that anchor setting activities was actually the greatest source of sound and drilling activities weren't as disruptive as previously thought. Effects from anchor handling can be limited during an exploration program and can be managed with the help of local SAs and PSOs to limit impacts to marine mammals. Additionally, AIO notes that in BOEM's analysis they state that thresholds for sounds disruption of bowheads is not fully understood (pg. 138); AIO offers some information to help guide BOEM in this assessment as this is an area which has been carefully analyzed by industry monitoring programs, aerial observations, and research.	BOEM agrees that the current mitigation structure in the Arctic has successfully minimized impacts on marine mammals. Appendix I identifies many of the mitigation measures that may be applied for bowhead and subsistence harvesting. The measures provided in Appendix I are not meant to be a comprehensive assessment of all mitigation programs that are in place. The CAA mitigation measures are important considerations, and will be analyzed further and considered in greater detail at subsequent stages of the NEPA process should a lease sale be scheduled in the Beaufort or Chukchi Sea. BOEM concurs with the statement that specific activities such as anchor handling and ice management are likely to produce locally higher source levels and greater potential for impacts within the spectrum of bowhead when compared to other activity sources. The document provides only generalized source levels for sound characterization, and therefore, specific impact analysis on a species is not within the scope of the PEIS. Impacts from specific sources would be analyzed in greater detail at subsequent stages of the NEPA process.
316	Teresa Imm, Arctic Iñupiat Offshore, LLC	AIO urges BOEM to highly consider to vast economic potential of the Arctic OCS. Exploration and development of the Arctic OCS represent a significant investment in the local North Slope, Alaskan, and national economy. In an environment of low oil prices, declining production on the North Slope, TAPS operating at 25% capacity, and a multibillion dollar State budget deficit, development of the Arctic OCS signifies an investment in our region, State, and Nation. The investment potential of the Arctic OCS would reverberate across the Arctic, Alaska, and the U.S. BOEM critically notes the limited infrastructure in the Arctic; AIO would like to note this as well in comparison with our neighboring Arctic nations. The Alaskan Arctic is a stark contrast with some of the neighboring Arctic nations. Oil and gas activities could stimulate this development which would contribute to the U.S. Arctic remaining viable and competitive with the neighboring nations. Examples of infrastructure which the oil and gas industry may stimulate are: an Arctic deep-water port, increased rescue capability, and onshore infrastructure.	The Population, Employment and Income Section (Chapter 4) addresses the potential economic, employment, and income benefits to that could be realized as a result of the Proposed Action. These estimates used BOEM's regional economic impact model (MAG-Plan) to produce the estimates of possible impacts. For additional information on the benefits and risks of the Alaska lease sales in the Proposed Program, see the Alaska OCS Region Benefits and Risks Section of the accompanying 2017-2022 Outer Continental Shelf Oil and Gas Leasing Proposed Program Decision Document. The "equitable sharing" analysis includes discussions of increased wages, additional jobs, increased tax collections, and revenue sharing likely to result from the Alaska sales. Under the No Action Alternative (Alternative D) any potential socioeconomic benefits from the Proposed Action would not occur. The sale-specific Alaska EISs will provide additional socioeconomic impact analyses.

Comment ID	Commenter	Comment	Response
317	Teresa Imm, Arctic Iñupiat Offshore, LLC	Development of the Arctic OCS would provide economic benefit across the local, state, and national governments. Ninety percent of the local government, North Slope Borough (NSB), is contrived from taxation and royalties from oil and gas activities. The NSB then provides all the essential services to the local communities. During the decline in onshore production, an influx from OCS development could continue to sustain the NSB and the communities. Similarly, increased throughput is critical for the longevity of TAPs, a key piece of national infrastructure. OCS development is essential to sustain TAPS and the Alaskan economy. Furthermore, the U.S. would benefit from increased production, national security, and energy independence.	The Population, Employment and Income Section (Chapter 4) addresses the potential economic, employment, and income benefits to that could be realized as a result of the Proposed Action. These estimates used BOEM's regional economic impact model (MAG-Plan) to produce the estimates of possible impacts. For additional information on the benefits and risks of the Alaska lease sales in the Proposed Program, see the Alaska OCS Region Benefits and Risks Section, of the accompanying 2017-2022 Outer Continental Shelf Oil and Gas Leasing Proposed Program Decision Document. The "equitable sharing" analysis includes discussions of increased wages, additional jobs, increased tax collections, and revenue sharing likely to result from the Alaska sales. Under the No Action Alternative (Alternative D) any potential socioeconomic benefits from the Proposed Action would not occur. TAPS is discussed in the Final PEIS under the section on Population, Employment, and Income and for Land Use and Infrastructure. The sale-specific Alaska EISs will provide additional socioeconomic impact analyses.

Comment ID	Commenter	Comment	Response
318	Teresa Imm, Arctic Iñupiat Offshore, LLC	AIO would like to emphasize that Camden Bay and Cross Island areas have already experienced oil and gas activities with minimal impacts (See ANIMIDA or cANIMIDA studies). AIO would like to highlight that the area proposed as an EIA for the Cross Island area includes the Liberty Project for which Hilcorp has proposed to develop an artificial island to develop the Liberty Reservoir; a project which has been studied for decades. AIO respectfully recommends that BOEM include the decades of data from MMS, BOEM, and other regulating entities which evaluate oil and gas activities in these proposed EIAs and concluded that impacts would be manageable. The existing Kaktovik exclusion by Presidential Order does not necessitate expansion at this stage. AIO respectfully advises that the Director refrain from designating these EIAs at the programmatic stage as there is not sufficient cause to warrant such a swathing designation which would have detrimental implications on the potential of this Program. ...Expanding the already designated areas of the Hanna Shoal Walrus Use Area (HSWUA) and the Coastal Buffer are not appropriate at the programmatic stage and do not provide added environment benefit. AIO witnessed Shell conduct safe exploration activities in the very area which BOEM plans to designate. AIO does not support these designations and does not see them as an added benefit to our region; rather, the designation of the Beaufort and Chukchi EIAs limit the potential of safe and responsible resource development in our region which would have detrimental effects to the Iñupiat people. AIO sees the designation of these EIAs as overly prescriptive and inappropriate at this stage of the leasing program.	BOEM acknowledges existing measures designed to deconflict use of the Arctic OCS and appreciates the long history of coordination that has gone into making these efforts successful. In the Final PEIS, BOEM included how development of an Alaska Conflict Management Plan as a condition of plan approval could mitigate impacts in lieu of excluding an EIA. The PEIS does not include any requirements for mitigations in EIAs. The PEIS analyzes mitigation measures up to and including exclusions of EIAs to reduce impacts. This information will be used to inform future decisions. The analyses provide information to the decisionmaker and no outcome is presumed.
109	Teresa Imm, ASRC Exploration, LLC	ASRC Exploration, LLC (AEX), a subsidiary of Arctic Slope Regional Corporation (ASRC), respectfully requests that the Bureau of Ocean Energy Management (BOEM) extend the comment period on the Draft Programmatic EIS by at least 30 days and conduct additional public meetings in the North Slope Borough communities of Alaska regarding the Draft PEIS.	On March 18, 2016, BOEM published a Notice of Availability of the Draft PEIS for the 2017-2022 Oil and Gas Leasing Program. NEPA requires a minimum 45-day comment period on Draft PEIS documents, a period which may be extended at the discretion of the agency issuing the document. In the case of the Five Year Draft PEIS, BOEM determined that 45 days was adequate and appropriate for a programmatic document. However, all stakeholders were encouraged to provide comments on the 2017-2022 Proposed Program during the comment period, which ended June 16, 2016. BOEM recognizes the importance of input from public stakeholders, and appreciates the timing constraints noted by the commenter.

Comment ID	Commenter	Comment	Response
225	Teresa Imm, ASRC Exploration, LLC	Wages earned, both indirect and direct, would reverberate across the state economy and the Lower 48. These direct and indirect impacts should be fully characterized in the PEIS as they have the potential to reverse the economic downturn of the State.	The Population, Employment and Income Section (Chapter 4) addresses the potential economic, employment, and income benefits to that could be realized as a result of the Proposed Action. These estimates used BOEM's regional economic impact model (MAG-Plan) to produce the estimates of possible impacts. The level of analysis in this chapter is appropriate for a programmatic EIS. More thorough assessments of direct and indirect economic impacts will be included in Arctic region-, lease sale-, or activity-specific NEPA documents prepared by BOEM. For additional information on the benefits and risks of the Alaska lease sales in the Proposed Program, see the Alaska OCS Region Benefits and Risks Section, of the accompanying 2017-2022 Outer Continental Shelf Oil and Gas Leasing Proposed Program Decision Document. The "equitable sharing" analysis includes discussions of increased wages, additional jobs, increased tax collections, and revenue sharing likely to result from the Alaska sales. It also addresses environmental risks of the program proposal, as well as those of the energy substitutes that would most likely take the place of OCS production in the absence of the proposed lease sales (No Action Alternative).
226	Teresa Imm, ASRC Exploration, LLC	AEX appreciates BOEM's acknowledgement that many of the impacts assessed cannot be properly analyzed at the programmatic stage and requests that BOEM caveat this throughout their analysis to promote a fair review by key stakeholders.	BOEM states the programmatic nature of the analysis as appropriate throughout the document.
227	Teresa Imm, ASRC Exploration, LLC	While BOEM has conducted extensive research in their consideration of the Proposed Program, AEX is concerned by the lack of traditional knowledge incorporated into BOEM's review. Traditional Knowledge should be fully incorporated into BOEM's analysis of the Proposed Program and expected impacts.	While the high level overview inherent in a national programmatic document does not lend itself to detailed descriptions of the affected environment and potential impacts, traditional knowledge (TK) is an integral part of BOEM analyses of Arctic program areas. The PEIS description of sociocultural systems focuses on subsistence activities, which are based on TK. This description is commensurate with the broad level of Proposed Action. Alternatives in the Chukchi and Beaufort Seas are based in large part on subsistence values and traditional knowledge. BOEM will conduct more detailed analysis at the lease sale, exploration, and development stages, including traditional knowledge.

Comment ID	Commenter	Comment	Response
228	Teresa Imm, ASRC Exploration, LLC	The presence of these management techniques, such as the Conflict Avoidance Agreement (CAA), is not fully characterized throughout BOEM's analysis. BOEM neglects to acknowledge that coexistence is a reality of activities in the OCS and is already occurring.	BOEM acknowledges existing management mechanisms, including the CAA implemented under the MMPA, throughout the document. In Chapter 4, BOEM points to the CAA as one of many in a suite of tools that could be used to avoid or minimize impacts to subsistence use from oil and gas activities. In the Final PEIS, BOEM includes an analysis of how an Alaska Conflict Management Plan as a condition of plan approval could reduce conflict with subsistence activities and help mitigate impacts. BOEM will conduct more detailed analysis in NEPA documents, as appropriate, at the lease sale and plan stages.
229	Teresa Imm, ASRC Exploration, LLC	AEX recommends that BOEM consider longer Arctic lease terms as an alternative in their analysis.	Analyzing longer lease terms is not within the scope of this PEIS, or the Proposed Action under consideration. The length of the primary term, or initial period, of an OCS lease is established by Congress. Section 8(b) of OCSLA establishes that the maximum length of any initial period can be ten years, and only when the Secretary finds that a longer period than the minimum term of five years is necessary to encourage exploration or development in areas characterized by unusually adverse conditions. Congressional action would be necessary to change the length of lease terms in the Arctic.
230	Teresa Imm, ASRC Exploration, LLC	Rather than analyzing the potential impacts separate from in-place mitigation measures, AEX request that BOEM more clearly note these existing regulations and consider listing the applicable existing mitigation measures so that critical stakeholders, like AEX, have this information available during their review. It would be helpful to AEX, and other key reviewers, if BOEM incorporated a chart in their analysis detailing the abundant regulations and mitigation measures already governing these impacts and OCS activities. AEX asks that, through BOEM's analysis, they consider the existing mitigation and how this alters potential impacts of the Proposed Program.	Mitigation measures could change between the PEIS and a lease sale, and individual lease stipulations could differ by program area or at the lease sale stage. In addition, some mitigation measures for marine mammals and birds would be implemented by other agencies. Analyses in Chapter 4 reference specific mitigation measures as appropriate and describe their benefits and impacts, but a more complete analysis is more appropriate at the lease sale level when specific measures are determined.
231	Teresa Imm, ASRC Exploration, LLC	AEX recommends that BOEM fully integrate data from industry acoustic monitoring programs, such as those conducted by Shell, BP, and Hilcorp, which monitor these potential impacts.	BOEM values the contributions from industry monitoring programs and has been a partner in many of the cooperative efforts. As such, a large number of resulting industry monitoring reports and publications were reviewed as part of this PEIS. Specific information from these industry monitoring programs could be used to inform mitigation measures at the lease sale stage. This level of detail is not appropriate for a programmatic level analysis.

Comment ID	Commenter	Comment	Response
232	Teresa Imm, ASRC Exploration, LLC	The economic implications of exploration and development are extensive. Exploration and development of the Arctic OCS would provide a much needed boon to the local, state, and National economy and can contribute significantly to the U.S. energy needs. A thorough analysis of the economic benefits is prudent in BOEM's assessment of impacts and AEX looks forward to this being evaluated in depth.	The Population, Employment and Income Section (Chapter 4) addresses the potential economic, employment, and income benefits to that could be realized as a result of the Proposed Action. These estimates used BOEM's regional economic impact model (MAG-Plan) to produce the estimates of possible impacts. Additionally, a cost (net) benefit analysis is presented in Chapter 2 of the PEIS which provides estimates of benefits and costs to society from the Proposed Action. The level of analysis in these chapters is appropriate for a programmatic EIS. More thorough assessments of direct and indirect economic impacts will be included in Arctic region-,lease sale-, or activity-specific NEPA documents prepared by BOEM. For additional information on energy needs and the benefits and risks of the Alaska lease sales in the Proposed Program, see the Alaska OCS Region Benefits and Risks Section, of the accompanying 2017-2022 Outer Continental Shelf Oil and Gas Leasing Proposed Program Decision Document. The “equitable sharing” analysis includes discussions of increased wages, additional jobs, increased tax collections, and revenue sharing likely to result from the Alaska sales. It also addresses environmental risks of the Program, as well as those of the energy substitutes that would most likely take the place in the absence of the proposed lease sales (No Action Alternative).
233	Teresa Imm, ASRC Exploration, LLC	BOEM estimates in their analysis that economic impacts should not have an impact on immediately adjacent communities. This is not a correct assessment.	New text has been added in the Population, Employment, and Income Section in Chapter 4 to address comment.
234	Teresa Imm, ASRC Exploration, LLC	The direct and indirect economic benefits on the local, state, and national scale are not fully characterized in the analysis of the economic impacts. AEX encourages BOEM to fully analyze the local economic impacts from oil and gas activities and how increased exploration and development benefits the local communities. Alternatively, AEX implores BOEM to consider the economic consequences to the local communities of failing to pursue Arctic OCS development.	BOEM has revised the text in Chapter 4 to address the lost opportunity of potential socioeconomic benefits that might be realized if the sale(s) were held. The level of analysis presented is appropriate for a programmatic EIS. More thorough assessments of both positive and negative socioeconomic impacts to Arctic communities will be presented in region, lease sale, or activity-specific NEPA documents prepared by BOEM.

Comment ID	Commenter	Comment	Response
235	Teresa Imm, ASRC Exploration, LLC	AEX encourages BOEM to reference previous NEPA reviews conducted on the area, along with BOEM's ongoing baseline data programs by reference whenever feasible throughout their analysis. Prior analyses BOEM might source to address their concern for a lack of environmental information includes: [provides list of references]. AEX expects that the BOEM NEPA review will utilize decades of data gathered and analyzed for Arctic OCS development, as well as the history of traditional knowledge gathered by the local peoples. AEX look forward to this being fully integrated in BOEM's analyses.	BOEM has referenced the appropriate NEPA reviews and studies throughout the PEIS.
236	Teresa Imm, ASRC Exploration, LLC	AEX requests that BOEM consider in their analysis the many mitigation measures in place, along with the jurisdiction of several regulating entities which manage adverse impacts to the environment. This information should be caveated throughout BOEM's analysis of Impact Producing Factors (IPFs) to facilitate key stakeholders review. BOEM indicates in their analysis that many of the potential impacts and the IPFs cannot be properly assessed at the programmatic stage in the leasing program. AEX supports this statement and echoes that BOEM's assessment is premature and incomplete without incorporating the appropriate traditional knowledge and the abundant scientific data. AEX looks forward to a deeper analysis and review of available traditional knowledge, scientific data, and an appreciation of existing mitigation measures as BOEM continues to conduct their due diligence.	The PEIS analyzes the potential impacts from leasing activities that could occur under the 2017-2022 Oil and Gas Leasing Program. The PEIS broadly characterizes the types of activities and the environmental impacts that could occur. Appendix I identifies the suite of existing mitigation measures employed to minimize or avoid impacts. The PEIS identifies additional mitigation that could be useful to reduce impacts, including activity restrictions, time-area closures, and conflict management processes. Decisions on specific mitigation measures, including their design and implementation, could be made throughout the phased leasing process. In addition, BOEM has made every effort to incorporate traditional knowledge into the discussions and analyses in the PEIS.
237	Teresa Imm, ASRC Exploration, LLC	We recognize the synergies between infrastructure and communications enhancement, and acknowledge that investment in our region will likely only occur if stimulated by oil and gas activities. Though as BOEM indicates, the Arctic may lack the level of infrastructure seen in the Gulf of Mexico, this does not inhibit oil and gas exploration. We have seen that safe and successful exploration conducted in the Arctic OCS. AEX emphasizes the need for added infrastructure if the Alaskan Arctic is to remain competitive, this can be spurred by oil and gas activities from the Proposed Program.	Text in the Sociocultural Systems Section (Chapter 4) has been revised per comment.

Comment ID	Commenter	Comment	Response
238	Teresa Imm, ASRC Exploration, LLC	Existing mitigation and ongoing coordination with the Iñupiat people is capable of managing the entire OCS, including the areas proposed by BOEM. AEX regards the potential designation of these EIAs as a disadvantage to the Iñupiat people and the Proposed Program. By BOEM's own analysis, "potential exclusions in the Beaufort Sea and Chukchi Sea Program Areas are likely to have the largest impact on activity levels given their relative size and location coincident with high hydrocarbon resource potential." Given this assessment, AEX find it inappropriate to exclude these areas over known reserves when existing mitigation measures are capable of minimizing impacts. AEX objects to the premature and sweeping designation of these areas by exclusion or "temporary" closures. Exclusion of these areas will significantly limit opportunity in the Arctic OCS, making the program areas technologically and economically unattractive. Given the EIAs resource potential, designation of the EIAs would limit opportunity in the Arctic program areas and deter exploration and production; both of which would have detrimental economic impacts to AEX and the Iñupiat people. Proposed temporary closures of these areas for the entirety of the open water season is equivalent to excluding them from leasing as it completely deters the possibility of exploration; this has equally negative effects to the Iñupiat people as closure. Designation of these areas would be draconian to the Arctic program area and Proposed Program.	BOEM acknowledges existing measures designed to deconflict use of the Arctic OCS and appreciates the long history of coordination that has gone into making these efforts successful. In the Final PEIS, BOEM included how development of an Alaska Conflict Management Plan as a condition of plan approval could mitigate impacts in lieu of excluding an EIA. The PEIS does not include any requirements for mitigations in EIAs. The PEIS analyzes mitigation measures up to and including exclusions of EIAs to reduce impacts. This information will be used to inform future decisions. The analyses provide information to the decisionmaker and no outcome is presumed.
240	Teresa Imm, ASRC Exploration, LLC	Additionally, AEX rejects the characterization in BOEM's PEIS that the Iñupiat people are unfamiliar with development and the infrastructure necessary to develop these potential leases. The Iñupiat people are an adaptive community whom recognize the harsh realities of living in the arctic environment, as well as the potential of the region's resources. In reality, we are closely acquainted with oil and gas operations and infrastructure as our region is home to the largest oil field in North America, along with several other prolific prospects.	BOEM appreciates the input received from Arctic stakeholders on the benefits, both positive and negative, that could result from the development of infrastructure in these areas. BOEM has updated the Final PEIS to more fully characterize these impacts.
241	Teresa Imm, ASRC Exploration, LLC	AEX is concerned that designation of these areas [EIAs] reflects a lack of confidence by BOEM of the current mitigation measures, coordination with communities, and traditional knowledge which supports management of the Arctic OCS; this attitude is discouraging to the mitigation programs that BOEM, North Slope communities, AEWC, NSB, operators and traditional knowledge holders have worked so hard to establish.	BOEM acknowledges existing measures to deconflict use of the Arctic OCS and appreciates the long history of coordination that has gone into making these efforts successful. In the Final PEIS, BOEM included how development of an Alaska Conflict Management Plan as a condition of plan approval could mitigate impacts in lieu of adapting other mitigation measures up to excluding an EIA.

Comment ID	Commenter	Comment	Response
287	Theresa Clark, Olgoonik Corporation	The proposed PEIS should not lock out areas completely. For example, BOEM added the walrus foraging area and walrus transportation area. Closing these areas completely is limiting. Walruses do not use these areas year round. BOEM should only close areas like these when necessary for the purposes such as these when it is absolutely necessary; not year round.	The PEIS analyzes mitigation measures up to and including exclusions of EIAs to reduce or avoid impacts. This information will be used to inform future decisions. The analyses provide information to the decisionmaker and no outcome is presumed.
288	Theresa Clark, Olgoonik Corporation	We also request that BOEM extend the deadline for comments on this Draft PEIS. Publishing this online six weeks before the deadline to comment is insufficient. Access to the internet and internet service itself is slow on the North Slope.	On March 18, 2016, BOEM published a Notice of Availability of the Draft PEIS for the 2017-2022 Oil and Gas Leasing Program. NEPA requires a minimum 45-day comment period on Draft PEIS documents, a period which may be extended at the discretion of the agency issuing the document. In the case of the Five Year Draft PEIS, BOEM determined that 45 days was adequate and appropriate for a programmatic document. However, all stakeholders were encouraged to provide comments on the 2017-2022 Proposed Program during the comment period, which ended June 16, 2016. BOEM recognizes the importance of input from public stakeholders, and appreciates the timing constraints noted by the commenter. In appreciation of the limited internet access on the North Slope, BOEM ensured that hard copies of the Draft PEIS were delivered to each community.
99	Theresa Haas	The PEIS does not sufficiently address the environmental impact in terms of climate change that the lease sale will have. Allowing for the extraction of fossil fuels through this lease sale is likely to have a huge impact in terms of contributing to the ongoing problem of climate change and a rise in global temperature, but the PEIS fails to thoroughly examine the environmental impact of this element of the proposal.	On August 1, 2016, the Council on Environmental Quality issued Final Guidance for the Consideration of Greenhouse Gas Emissions and the Effects of Climate Change in National Environmental Policy Act Reviews. The Final PEIS addresses the effects of climate change consistent with that guidance, including describing the sensitivity of resources to future impacts because of a changing climate. BOEM has also quantified downstream greenhouse gas emissions as a proxy for assessing climate change effects.
100	Theresa Haas	The PEIS does not sufficiently address the environmental impact of a potential oil spill. The long-term and devastating impacts of this type of spill [Deepwater Horizon], or one that is potentially worse, is not sufficiently discussed for all affected regions in the PEIS.	Impacts of oils spills are discussed generally for the regions included in the Accidental Spills and Catastrophic Discharge Events Section (Chapter 4) and more specifically for each resource in Potential Impacts per Resource Area Section (Chapter 4). Additionally, each resource discusses and gives the rating for spill impacts of accidental spills and a catastrophic discharge event (CDE) within the Potential Impacts per Resource Area Section. If the program area has a lease sale, more detailed consideration of potential CDE impacts will be included.

Comment ID	Commenter	Comment	Response
209	Tom Lakosh, Alaska Wilderness League	I would appreciate further investigation by BOEM to analyze the state-of-the-art technology, to ensure that it could potentially conform with ESA protections and OPA 90 protections, to establish the impact, in accordance with those mandates, and that to otherwise suspend operations, unless and until it can be established that the state-of-the-art technology is capable of meeting those mandates.	The issue of regulatory and safety procedures is briefly discussed in several sections of the PEIS to provide a broad overview within a programmatic context (see Chapter 1 Key Agency Responsibilities, Appendix I, and Appendix J). It is noteworthy that the PEIS, as a programmatic document, provides a broad analysis of the projected levels of exploration, development, production, and decommissioning activities which result from leasing during the 2017-2022 period. This level of projected future activity is one of the cornerstones for predicting the frequency and nature of potential accidents, including spills and catastrophic discharge events. It is noted in Chapter 2 (Range of Alternatives) that the implementation of protective measures and requirements for safe operations and environmental protection is expected to continue into the future. This statement also applies to state-of-the-art technologies, and their potential application to offshore oil and gas exploration, development, production, and decommissioning/abandonment; this issue is most appropriately addressed in future lease sale analyses or project-specific documentation or plans. It is at this stage where state-of-the-art technology, if proposed, would be analyzed and considered under the ESA's Section 7 Consultation requirements in terms of potential impacts to protected species and designated critical habitat so as ensure that the new technologies would not jeopardize or adversely modify critical habitat. The Oil Pollution Act (OPA90) requires removal of spilled oil and establishes a national system of planning for, and responding to, oil spill incidents. Complying with OPA90 and providing adequate oil spill contingency plans that include oil spill containment and cleanup equipment and financial responsibility is required by vessel and facility owners. Agency approval of OPA90 required spill response plans including acceptable spill response methods and specifics will occur later in the NEPA process, and is beyond the scope of the PEIS. No revisions to the PEIS are required.
45	Tracy Stephens, ACTS-Achieving Community Tasks Successfully	How far does the contaminated chain go from the ocean to the end? Has this really been studied?	BOEM recognizes that the ingestion of contaminated prey could lead to bioaccumulation of harmful compounds and could implicate ecosystem level processes. This is referenced as appropriate in the Final PEIS and the level of detail is consistent with a programmatic analysis. Additional information on this potential impact, including incorporation of the most recent available science, will be analyzed at the lease sale stage if appropriate.

Comment ID	Commenter	Comment	Response
3	Tristan Glowa	I additionally encourage BOEM to consider closely the 2015 paper from McGlade and Ekins, published in Nature entitled "The geographic distribution of fossil fuels unused when limiting global warming to 2°C." This paper, as with other calculations of greenhouse gas budgets, makes clear that the vast majority of fossil fuels must remain unused. But very significantly, by looking at the carbon content and global perspective, it concludes that Arctic fossil fuel reserves must not be extracted for any hope of remaining in a safe level of warming. From my discussion with BOEM representatives, it seemed to be the opinion of the agency that the use of Arctic reserves would displace more carbon intense fuel sources. However, it should be apparent that if these fossil fuels are extracted, they will invariably be sold.	BOEM has incorporated the analysis from McGlade and Ekins into the PEIS, along with a brief discussion of how it relates to the emissions from the Proposed Action.
5	Tristan Glowa	To open the subsistence of the ocean to damage through industrial development and the inevitable spills and pollution that will accompany is not consistent with Environmental Justice.	The purpose of this analysis is to disclose the potential impacts that could occur as a result of lease sales issued under the 2017-2022 Program. The Environmental Justice analysis in the PEIS fully discloses the potential impacts that could disproportionately affect low income and minority populations. This analysis is done at a high-level, consistent with a programmatic document.
123	Two commenters (Christin Anderson and Princess Lucaj)	The PEIS fails to mention impacts of the Arctic oil lease sales on the Sociocultural Systems of neighboring areas such as the Bering Sea, the route for ship traffic to and from the Chukchi and Beaufort Seas.	The Sociocultural Systems Section has been revised per comment.
523	Wainwright Transcripts	The people of Wainwright want the Hanna Shoal area to remain at the status quo, and request that no further restrictions be placed on the area. Around Cross Island, the area should remain open for leasing due to the use of Conflict Avoidance Agreements that limit the traffic during the hunting season.	The analyses in the PEIS provide information to the decisionmaker and no outcome is presumed. The Conflict Avoidance Agreement process is administered by the National Marine Fisheries Service to mitigate impacts to subsistence resources as required under the Marine Mammal Protection Act. However, BOEM recognizes that a mechanism to facilitate communication and planning to reduce or avoid conflict is a valuable approach to mitigate potential impacts from oil and gas activities. This Final PEIS analyzes requirement of a Conflict Management Plan for the Alaska program areas that would facilitate coordination and communication between local communities and OCS oil and gas activities. Determinations about specific mitigation measures and how they could be implemented generally occurs at the lease sale phase.

Comment ID	Commenter	Comment	Response
81	Yudith Nieto, Texas Environmental Justice Advocacy Services	In the IPFs in the Draft Programmatic EIS there is no mention of a program for funds set in place after a potential spill. After the spill, communities that have been impacted need to know that in case of catastrophic event, not only do they know how to react about it, but also what exists in order to help with clean up. In case of a spill, leak, or explosion, the surrounding communities need to be alerted, no matter how big or small. This can help eliminate the risk of exposure and contamination. Mitigation needs to happen as soon as something goes awry and a public hearing needs to be set.	Oil spill financial responsibilities, including assurance certificates of adequate financial resources for spill response and remediation, is required for offshore vessel and facility operators as part of the Oil Pollution Act of 1990 to conduct business in United States waters. Oil spill response activities and associated financial responsibilities are included in general terms in Appendix I, Mitigation and Protective Measures, and Appendix J, Federal Laws and Executive Orders in the PEIS.
83	Yudith Nieto, Texas Environmental Justice Advocacy Services	Communities need to be at the table when these decisions are being made and projects are being drafted. I read that this Bureau conducted surveys to find out what communities thought of the project. However, I did not see this information translated to Spanish. Which is problematic, due to the fact that this is the Gulf of Mexico being proposed for drilling, the majority of the communities found near the Gulf are often times Spanish-speaking communities. As well as, Vietnamese communities. There is also a need to be more inclusive and diverse in the language that this information is being translated to.	BOEM recognizes the importance of stakeholder input and strives to ensure everyone can participate. Federal regulations do not require the government to publish documents in foreign languages. However, with advance notice, BOEM will accommodate requests for translators at public meetings to aid in communicating the information presented in the documents and providing an opportunity for open dialogue with non-English speaking members of the community.
84	Yudith Nieto, Texas Environmental Justice Advocacy Services	The communities most impacted, or "sacrifice zones," are the biggest stakeholders who understand the need to be part of the decisionmaking process. These are coastal communities who are predominantly people of color, are undocumented, uninsured, and disenfranchised. We need to better protect them and ecosystems that are still being impacted by the 2010 BP oil spill. A recommendation to be made is to have an advisory committee in every community that the offshore drilling might impact. That way the industry has direct contact to community liaisons at all times and community is always informed to make a decision that helps them in protecting the health of their communities.	BOEM outreach and community inreach prior to a decision being made is an excellent way to facilitate a more robust public process. BOEM recognizes the importance of stakeholder input and strives to ensure everyone can participate. The Draft PEIS was made available for review on the BOEM website and at public meetings, and was sent via BOEM mailing list or specific request. Comments on the Draft PEIS could be submitted either in person or electronically at the public meetings, via mail, or to regulations.gov website during the 45-day comment period. Online access to the document and comment submittal opportunities either in person, online or via mail provided several mechanisms for public comment. BOEM is open to feedback on ways to communicate with potentially affected coastal communities.

This page intentionally left blank

Appendix H

List of Preparers

This page intentionally left blank

BOEM

Name	Education/Expertise	Contribution
Ololade Ajilore	M.S., Environmental Science and Policy; 7 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; 18 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; 40 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 Habitats
Bruce Baird	M.S. Biological Oceanography; 31 years of experience in Marine Biology, Coastal Ecology, and NEPA.	Coastal and Estuarine Habitats
Mark Belter	B.S., Biology; 8 years of experience working with fisheries, marine biology and habitat restoration.	Fish and EFH
David Bigger	Ph.D., Biology; 20 years of experience in ecology, scientific research, NEPA, ESA, and MBTA.	Coastal and Estuarine Habitats
Kimberly Bittler	M.S. Marine Science; 6 years experience in environmental science and policy.	Comment Coordination and Resolution
Gregory Boland	M.S. Biological Oceanography; 42 years of experience in biological oceanography studies, field work and assessment, NEPA and EFH on Gulf of Mexico fisheries and benthic communities	Marine Benthic Resources
Jennifer Bosyk	B.S., Biology; M.E.M., Coastal Environmental Management; 11 years of experience in marine mammal and sea turtle conservation biology; impact assessment; and ocean policy.	Project Management Team; Marine Mammals
Mary Cody	B.A., 27 years of experience with seabird and marine mammal research, NRDA and Recovery monitoring, MMPA management and enforcement, NEPA, ESA consultation.	Birds, Marine Mammals, Alternatives Development
Kim Coffman	M.P.P., Government in the Private Economy (emphasis on Economic and Inter-disciplinary Analysis of Public Policy); 26 years of experience working on OCS/5-Year Program issues, 18 years of experience with socioeconomic models.	Socioeconomics
Sarah Peters Coffman	M.A. and B.A., Economics; 7 years of experience in economic analysis.	Economics, Socioeconomics
Jennifer Culbertson	B.S., M.A., Ph.D., Marine Biology; 19 years of experience in marine ecosystems and impacts associated with oil in the marine environment.	Water Quality, Quantification of Accidental Spills
Megan Davidson	M.S. Biological Oceanography; 13 years of experience in biological oceanography working on a variety of environmental related issues and field work.	Project Management Team; E&D Scenarios, Cooperating Agency Coordination, Comment Coordination and Resolution
Stephanie Fiori	B.S. Environmental Science, B.A. Policy Studies MSc Environmental Sciences and Policy; 15 years of experience in the environmental science field	Comment Coordination and Resolution

Name	Education/Expertise	Contribution
Deena Hansen	M.S., Marine Science; 9 years of experience in marine and fisheries ecology, in the field and for desktop analyses, especially in the context of NEPA, ESA, MSFCMA, and OCSLA regulations.	Fish and EFH, Commercial and Recreational Fisheries
Keely Hite	B.S., Environmental Science; 10 years of experience NEPA OCS Programs HQ Tribal G-2-G Coordinator, Sociocultural/Socioeconomic SME, BOEM EJ Lead.	Environmental Justice, Tourism and Recreation
Tim Holder	B.A., Economics; Master of Urban Planning; 26 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 Systems, Human Health
Mark Jensen	M.S., Economics; 8 years experience in NEPA and economic analysis.	Economics
Brian Jordan	B.A., Anthropology; M.S., Wood Science; Ph.D., Natural Science and Resource Management; 21 years of experience in various aspects of maritime archaeology and underwater cultural heritage management, 12 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; 31 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; 16 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; 23 years of experience in protected species assessment.	Supervision, Alternatives, QA/QC
Robert Martinson	B.S., Biological Science M.S. Zoology, 37 years of experience working on NEPA, ESA, CWA, Aquatic Ecology, Wetlands, Estuarine Ecology, and Coastal Restoration.	Project Management Team; Coastal and Estuarine Habitats, QA/QC
Davie Nguyen	B.A., Social Ecology; M.E.M., Environmental Management; 6 years of experience in NEPA, ocean policy, waste management.	Land Use and Infrastructure
Doug Piatkowski	B.S., M.S., Marine Biology; 14 years of experience in marine ecosystems and preparing NEPA and protected species assessments.	Sea Turtles

Name	Education/Expertise	Contribution
Jennifer Rose	M.S., Environmental Science and Policy, 12 years of experience in environmental analysis and contamination testing.	Project Management Team; Technical editing and document formatting
Katherine Segarra	B.S., Environmental Science; Ph.D., Marine Sciences; B.S., Environmental Science; 14 years years of 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.	Socioeconomics
Poojan Tripathi	M.S., Plant and Soil Science; 12 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; 16 years of experience in coastal geomorphology and oceanography.	Supervision, Project Management Team, E&D Scenario, QA/QC
Eric Wolvovsky	B.S., Meteorology; M.S., Geographic Information Systems. 5 years of air quality experience.	Air Quality, Climate Change, Mapping

Contractors

Name	Contribution
CSA Ocean Sciences, Inc.	Water Quality, Marine Benthic Communities, Pelagic Communities, Birds, Marine Mammals and Sea Turtles, Fish and EFH, and Socioeconomic, Environmental Justice, and Commercial and Recreational Fishing technical input and review; mapping and graphics.
Southeastern Archaeological Research, Inc. (SEARCH)	Archaeological and Historic Resources technical input
ESS Group, Inc.	Marine and Coastal 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
High Tide Environmental	Arctic Terrestrial Wildlife and Habitats
Natalie Kraft	Technical review, editing
Sara Spence	Technical review

This page intentionally left blank

Appendix I

Mitigation and Protective Measures

This page intentionally left blank

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. The primary resource for this information is the Notice to Lessees and Operators webpage on the BOEM website (USDOI, BOEM, 2015).

1. GULF OF MEXICO REGION

1.1. LEASE STIPULATIONS

1.1.1. Topographic Features

This stipulation designates a "No Activity Zone" around numerous underwater topographic features commonly called "banks," whose crests could contain benthic 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. Blocks subject to this lease stipulation are included in the Biologically-Sensitive Underwater Features EIA (**Section 4.4.6.2**); if this EIA is selected for Programmatic Mitigation, any lease issued under the 2017-2022 Program for one of these blocks would include these required mitigation measures.

Refer to NTL No. 2009-G39 – Biologically-Sensitive Underwater Features and Areas at the following website: 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. Blocks subject to this lease stipulation are included in the Biologically-Sensitive Underwater Features EIA (**Section 4.4.6.2**); if this EIA is selected for Programmatic Mitigation, any lease issued under the 2017-2022 Program for one of these blocks would include these required mitigation measures.

Refer to NTL No. 2009-G39 – Biologically-Sensitive Underwater Features and Areas at the following website: 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 at the following website: 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 (EFH), 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 Region Supervisor for Office of Leasing and Plans, 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.

- Notice of Sale Cook Inlet Oil and Gas Lease Sale 191. http://www.boem.gov/uploadedFiles/BOEM/Oil_and_Gas_Energy_Program/Leasing/Regional_Leasing/Alaska_Region/Alaska_Lease_Sales/Sale_191/Coversheet-Sale-191.pdf

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.
- Notice of Sale Cook Inlet Oil and Gas Lease Sale 191.
- http://www.boem.gov/uploadedFiles/BOEM/Oil_and_Gas_Energy_Program/Leasing/Regional_Leasing/Alaska_Region/Alaska_Lease_Sales/Sale_191/Coversheet-Sale-191.pdf

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.
- Notice of Sale Cook Inlet Oil and Gas Lease Sale 191.
- http://www.boem.gov/uploadedFiles/BOEM/Oil_and_Gas_Energy_Program/Leasing/Regional_Leasing/Alaska_Region/Alaska_Lease_Sales/Sale_191/Coversheet-Sale-191.pdf

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.
- Notice of Sale Cook Inlet Oil and Gas Lease Sale 191. http://www.boem.gov/uploadedFiles/BOEM/Oil_and_Gas_Energy_Program/Leasing/Regional_Leasing/Alaska_Region/Alaska_Lease_Sales/Sale_191/Coversheet-Sale-191.pdf

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 Office of Leasing and Plans, 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.
- Final Notice of Sale Package Chukchi Sea Oil and Gas Lease Sale 193. http://www.boem.gov/uploadedFiles/BOEM/About_BOEM/BOEM_Regions/Alaska_Region/Leasing_and_Plans/Leasing/Lease_Sales/Sale_193/Info.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.
- Final Notice of Sale Package Chukchi Sea Oil and Gas Lease Sale 193. http://www.boem.gov/uploadedFiles/BOEM/About_BOEM/BOEM_Regions/Alaska_Region/Leasing_and_Plans/Leasing/Lease_Sales/Sale_193/Info.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 (*Somateria fischeri* or *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.
- Final Notice of Sale Package Chukchi Sea Oil and Gas Lease Sale 193. http://www.boem.gov/uploadedFiles/BOEM/About_BOEM/BOEM_Regions/Alaska_Region/Leasing_and_Plans/Leasing/Lease_Sales/Sale_193/Info.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. 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.

4. 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 J**.

- National Ambient Air Quality Standards (NAAQS) as required by the Clean Air Act (CAA) and administered by the 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).

- Mitigation measures as applied through consultations with USFWS and the National Marine Fisheries Service (NMFS) aimed to ensure the protection of any endangered or threatened species, marine mammal, and their critical habitat. Examples of 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).

- EFH designations and protections as required by FCMA and administered by NMFS.

REFERENCES

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.

This page intentionally left blank

Appendix J

Federal Laws and Executive Orders

This page intentionally left blank

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. The Bureau of Safety and Environmental Enforcement (BSEE) regulations are listed under 30 CFR Part 250, 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 CAA, 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 550 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 in compliance with BOEM's air quality regulations.

On April 5th, 2016 BOEM proposed updates to its air quality regulations in the Federal Register, Air Quality Control, Reporting, and Compliance (2016). The proposed changes include, but are not limited to: updates addressing all criteria pollutants; allows BOEM to update emission exemption levels; revising the point of air quality compliance to the State seaward boundary; calculating emissions from support vessels without regard to the distance they are from a facility; changing the locations from where air emissions will be measured and evaluated; changing the circumstances when emissions reduction measures are required; establishing requirements for the consolidation of emissions; and adding a new requirement for all plans to be reviewed at least every 10 years.

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 within state waters. 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.

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. MPAs 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.

Areas of Special Concern are analogous to marine protected areas and include federally managed areas (e.g., Marine Protected Areas [MPAs], National Marine Sanctuaries [NMSs], National Parks, NWRs), and areas that have been given special designations by Federal and state agencies (e.g., National Estuarine Research Reserves [NERRs], national estuary program sites, and state-designated MPAs). MPAs are designed to achieve a variety of goals generally falling within 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. MPAs are created by a specific Federal, state, or tribal entity, which receives its authority from a statute or treaty. MPAs are not the same as the EIAs discussed in this document, although there could be some overlap. Because MPAs focus specifically on the protection of habitat and specific biological and cultural resources while providing appropriate and compatible recreational opportunities, the impacts on these categories are discussed in their respective sections. This fulfills the requirement that each “federal agency whose actions affect the natural or cultural resources that are protected by an MPA shall identify such actions. To the extent permitted by law and to the maximum extent practicable, each federal agency, in taking such actions, shall avoid harm to the natural and cultural resources that are protected by an MPA. In implementing this section, each federal agency shall refer to the MPAs identified under subsection 4(d) of this order [i.e., the National System of MPAs]” (Executive Order [E.O.] 13158 Section 5).

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. In addition, the Secretary of the Interior signed a policy in 2012 that created a framework for consulting with Alaska Native Claims Settlement Act of 1971 (ANCSA) Corporations. The policy is intended to clearly establish the need to adhere to Congressional intent that required all Federal agencies to consult with ANCSA Corporations on the same basis as Indian tribes under EO 13175. However, the Department of the Interior distinguishes the Federal relationship to ANCSA Corporations from the government-to-government relationship between the Federal Government and federally recognized Indian Tribes in Alaska and elsewhere.

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.

This page intentionally left blank