OCS Report
BOEM 2016-016

Outer Continental Shelf

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

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ABBREVIATIONS AND ACRONYMS

°C	degrees Centigrade
°F	degrees Fahrenheit
BOEM	Bureau of Ocean Energy Management
BOP	blowout preventer
BSEE	Bureau of Safety and Environmental Enforcement
CD	consistency determination
CFR	Code of Federal Regulations
CG	U.S. Coast Guard (also USCG)
CMP	Coastal Management Program
COE	Corps of Engineers, U.S. Dept. of the Army
CZMA	Coastal Zone Management Act
DOCD	development operations coordination document
DOI	Department of the Interior (also USDOI)
DPP	development and production plan
e.g.	for example
EEZ	Exclusive Economic Zone
EFH	essential fish habitat
Eh	oxidation reduction potential
EIS	environmental impact statement
EP	exploration plan
et al.	and others
Five-Year Program	*Proposed Outer Continental Shelf Oil & Gas Leasing Program: 2017-2022*
FMP	Fishery Management Plan
ft	feet
FWS	Fish and Wildlife Service (U.S.)
G&G	geological and geophysical
GMFMC	Gulf of Mexico Fishery Management Council
GOM	Gulf of Mexico
HAPC	habitat area of particular concern
Hz	hertz
i.e.	that it
km	kilometer
m	meter
MARAD	Maritime Administration (U.S. Department of Transportation)
mi	mile
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NOS	Notice of Sale
NPDES	National Pollution Discharge Elimination System
NTL	Notice to Lessees and Operators

OCS	Outer Continental Shelf
pH	potential of hydrogen
PSBF	potentially sensitive biologic features
ROD	Record of Decision
TTS	temporary threshold shift
U.S.	United States
USCG	U.S. Coast Guard (also CG)
USDHS	U.S. Department of Homeland Security
USDOC	U.S. Department of Commerce
USDOI	U.S. Department of the Interior (also DOI)
USDOT	U.S. Department of Transportation
USEPA	U.S. Environmental Protection Act

1 PROPOSED ACTIONS

Purpose of and Need for the Proposed Actions

The Federal actions addressed in this Essential Fish Habitat Assessment are proposed Outer Continental Shelf (OCS) Lease Sales 249, 250, 251, 252, 253, 254, 256, 257, 259, and 261 in the Gulf of Mexico (GOM) and the related pre- and postlease activities, including but limited to, geological and geophysical (G&G) activities and decommissioning operations. The proposed lease sales will provide qualified bidders the opportunity to bid upon and lease acreage in the Gulf of Mexico OCS to explore, develop, and produce oil and natural gas. The G&G and related activities aid in exploration, development, and production while decommissioning operations complete the life cycle of the structures. This Assessment analyzes the potential impacts of a proposed action on the GOM managed species and related essential fish habitat (EFH) for the *Proposed Outer Continental Shelf Oil & Gas Leasing Program: 2017-2022* (Five-Year Program). There is a full National Environmental Policy Act (NEPA) review conducted for lease sales included in the Five-Year Program. There are also NEPA documents for G&G and decommissioning operations in the GOM. These documents are referenced as needed.

Related Activities

Lease Sales: This proposed action would offer for lease the available unleased blocks in the proposed lease sale areas for oil and gas exploration and recovery operations.

Geological and Geophysical Activities: This proposed action would provide permits to conduct G&G survey activities between the coastline (excluding estuaries) and the Exclusive Economic Zone (EEZ) of the GOM to examine prospective areas for oil and gas, renewable energy, and marine minerals and to determine the quality and quantity of resources in these prospective areas.

Decommissioning Operations: This proposed action is managed by the Bureau of Safety and Environmental Enforcement (BSEE) and encompasses activities that include the following: (1) equipment and vessel mobilization and target preparation; (2) underwater structural-member severance (nonexplosive and explosive methods); (3) post-severance salvage; and (4) final site-clearance verification.

Prelease Process

For the lease sales' proposed action, scoping was conducted in accordance with the Council on Environmental Quality's regulations implementing NEPA. The Bureau of Ocean Energy Management (BOEM) conducts early coordination with appropriate Federal and State agencies and other concerned parties to discuss and coordinate the prelease process for the proposed lease sales and the environmental impact statement (EIS). Key agencies and organizations include the National Oceanic and Atmospheric Administration's (NOAA) National Marine Fisheries Service (NMFS), U.S. Fish and Wildlife Service (FWS), U.S. Department of Defense, U.S. Coast Guard (USCG), U.S. Environmental Protection Agency (USEPA), State Governors' offices, and industry groups. BOEM sends copies of the Draft Multisale EIS for review and comment to Federal, State, and local governments, federally recognized Indian Tribes, nongovernmental organizations, and other interested parties.

As part of this process, BOEM performs consistency reviews pursuant to the Coastal Zone Management Act (CZMA), and a Consistency Determination (CD) is prepared for each potentially affected CZMA State prior to each proposed lease sale. To prepare the CDs, BOEM reviews each CZMA State's Coastal Management Program (CMP) and analyzes the potential impacts as outlined in the Draft Multisale EIS, new information, and applicable studies as they pertain to the enforceable policies of each CMP. Based on the analyses, BOEM's Director makes an assessment of consistency, which is then sent to each CZMA State's CMP with the Proposed Notice of Sale (NOS).

The Final Multisale EIS is published approximately 5 months prior to the first proposed lease sale. To initiate the public review and 30-day minimum comment period, BOEM publishes a Notice of Availability in the *Federal Register*. BOEM sends copies of the Final Multisale EIS for review and comment to Federal, State, and local governments, federally recognized Indian Tribes, nongovernmental organizations, and other interested parties. After the end of the comment period, the U.S. Department of the Interior (USDOI or DOI) will review the Final Multisale EIS along with all comments received.

A Record of Decision (ROD) will identify the alternative chosen. The ROD will summarize the proposed action and the alternatives evaluated in the Multisale EIS, the conclusions of the impact analyses, and other information considered in reaching the decision. All comments received on the Final Multisale EIS will be addressed in the ROD.

A Proposed NOS will become available to the public 4-5 months prior to a proposed lease sale. If the decision by the Assistant Secretary of the Interior for Land and Minerals Management is to hold a proposed lease sale, a Final NOS will be published in its entirety in the *Federal Register* at least 30 days prior to the lease sale date, as required by the Outer Continental Shelf Lands Act.

Postlease Activities

Measures to minimize potential impacts are an integral part of the OCS Program. These measures are implemented through lease stipulations, operating regulations, Notices to Lessees and Operators (NTLs), and project-specific requirements or conditions of approval. These measures address concerns including endangered and threatened species, geologic and manmade hazards, military warning and ordnance disposal areas, archaeological sites, air quality, oil-spill response planning, sensitive benthic communities, artificial reefs, operations in hydrogen sulfide prone areas, and shunting of drill effluents in the vicinity of biologically sensitive features.

A G&G permit must be obtained from BOEM prior to conducting off-lease G&G exploration or scientific research on unleased OCS lands or on lands under lease to a third party (30 CFR §§

551.4(a) and (b)). Geological investigations include various seafloor sampling techniques to determine the geochemical, geotechnical, or engineering properties of the sediments.

Formal exploration plans (EPs), development and production plans (DPPs), and development operations and coordination documents (DODCs) (30 CFR §§ 550.211 through 550.273) with supporting information must be submitted for review and approval by BOEM before an operator may begin exploration, development, or production activities on any lease. Supporting environmental information, archaeological reports, biological reports (monitoring and/or live-bottom survey), and other environmental data determined necessary must be submitted with an OCS plan.

The EP describes exploration activities, drilling rig or vessel, proposed drilling and well-testing operations, environmental monitoring plans, and other relevant information, and it includes a proposed schedule of the exploration activities. A DPP describes the proposed development activities, drilling activities, platforms or other facilities, proposed production operations, environmental monitoring plans, and other relevant information, and it includes a proposed schedule of development and production activities.

Technologies continue to evolve to meet the technical, environmental, and economic challenges of deepwater development. New or unusual technologies may be identified by the operator in its EP, deepwater operations plan, and DPP or through BOEM's plan review processes. The operating procedures developed during the engineering, design, and manufacturing phases of the project, coupled with the results (recommended actions) from hazard analyses performed, will be used to develop the emergency action and curtailment plans. This technology is also reviewed by the NMFS. The lessee must use the best available and safest technology to enhance the evaluation of abnormal pressure conditions and to minimize the potential for uncontrolled well flow.

Prior to conducting drilling operations, the operator is required to submit and obtain approval for an Application for Permit to Drill from BSEE. Besides the application process, the lessee must design, fabricate, install, use, inspect, and maintain all platforms and structures on the OCS to assure structural integrity for the safe conduct of operations.

A permanent abandonment includes the isolation of zones in the open wellbore, plugging of perforated intervals, plugging the annular space between casings (if they are open), setting a surface plug, and cutting and retrieving the casing at least 15 feet (ft) (5 meters [m]) below the mudline. This also must be addressed in the application.

Regulatory processes and jurisdictional authority concerning pipelines on the OCS and in coastal areas are shared by several Federal agencies, including DOI, the Department of Transportation (USDOT), the U.S. Army Corps of Engineers (COE), the Federal Energy Regulatory Commission, and the USCG. Pipeline applications are usually submitted to BSEE and reviewed by BOEM separately from DOCDs. Pipeline applications may be for on-lease pipelines or rights-of-way for pipelines that cross other lessees' leases or unleased areas of the OCS. Pipeline permit applications include the pipeline location drawing, profile drawing, safety schematic drawing, pipe design data, a shallow hazard survey report, and an archaeological report, if applicable. The BSEE evaluates the design, fabrication, installation, and maintenance of all OCS pipelines. Applications for pipeline decommissioning must also be submitted for review and approval. Decommissioning applications are evaluated to ensure that they will render the pipeline inert and/or to minimize the potential for the pipeline becoming a source of pollution by flushing and plugging the ends and to minimize the likelihood that the decommissioned line will become an obstruction to other users of the OCS by filling it with water and burying the ends.

The BSEE will provide for both an annual scheduled inspection and a periodic unscheduled (unannounced) inspection of all oil and gas operations on the OCS. The inspections are to assure compliance with all regulatory constraints that allowed commencement of the operation. The lessee is required to use the best available and safest drilling technology to enhance the evaluation of conditions of abnormal pressure and to minimize the potential for the well to flow or kick. Because blowout preventers (BOPs) are important for the safety of the drilling crew, as well as the rig and the wellbore itself, BOPs are regularly inspected, tested, and refurbished. The BSEE's responsibilities under the Oil Pollution Act of 1990 include spill prevention, review, and approval of oil-spill-response plans; inspection of oil-spill containment and cleanup equipment; and ensuring oil-spill financial responsibility for facilities in offshore waters located seaward of the coastline or in any portion of a bay that is connected to the sea either directly or through one or more other bays. The responsible party for covered offshore facilities must demonstrate oil-spill financial responsibility, as required by BOEM's regulation at 30 CFR part 553. Under 30 CFR part 250.1500 subpart O, BSEE has outlined well control and production safety training program requirements for lessees operating on the OCS.

2 GUIDANCE AND STIPULATIONS

Because of the inherent disturbance that occurs to the seafloor due to oil and gas operations, BOEM developed guidance to protect most sensitive EFH and live bottom areas, including topographic features, live bottom Pinnacle Trend habitats, low-relief live bottom habitats, and potentially sensitive biologic features (PSBFs). Guidance documents and resulting stipulations were developed in consultation with various Federal agencies and comments solicited from State, industry, environmental organizations, and academic representatives. Mitigating measures that are a standard part of the Bureau of Ocean Energy Management's OCS Program limit the size of explosive charges used for platform removal, require placing explosive charges at least 15 ft (5 m) below the mudline, establish No Activity and Modified Activity Zones around high-relief live bottoms, and require remote-sensing surveys to detect and avoid biologically sensitive areas such as low-relief live bottoms, pinnacles, and chemosynthetic communities.

The NTL 2009-JOINT-G39 ("Biologically-Sensitive Underwater Features and Areas") and NTL 2009-JOINT-G40 ("Deepwater Benthic Communities") offer guidance about the codified regulations at 30 CFR § 550.216(a), 30 CFR § 550.247(a), 30 CFR § 550.221(a), 30 CFR § 550.282, and 30 CFR § 250.552(a). These are information regulations for EPs, DOCDs, and DPPs and monitoring programs, and report regulations. The NTL 2009-JOINT-G39 describes the Topographic Features, Live Bottom (Pinnacle Trend), and Live Bottom (Low-Relief) Stipulations.

The Biological Stipulation Map Package (http://www.boem.gov/Regulations/Notices-To-Lessees/Notices-to-Lessees-and-Operators.aspx) includes drawings of each bank with associated protection zones.

3 HABITATS

Gulf of Mexico Essential Fish Habitat Program and Policies

Pursuant to Section 305(b) of the Magnuson-Stevens Fishery Conservation and Management Act, Federal agencies are required to consult with the NMFS on any action that may result in adverse effects to EFH. The NMFS published the final rule implementing the EFH provisions of the Magnuson-Stevens Fisheries Conservation and Management Act (50 CFR part 600) on January 17, 2002. Certain OCS activities authorized by BOEM may result in adverse effects to EFH and require consultation.

This EFH assessment will serve as the initiation of a Programmatic Consultation from the Gulf of Mexico OCS Region's oil- and gas-related activities for 2017-2022. Based on the most recent and best available information, BOEM will also continue to evaluate and assess risks to managed species and identified EFH in upcoming environmental compliance documentation under NEPA and other statutes. The EFHs that are covered in related BOEM environmental documents are water column, wetlands, seagrass communities/aquatic macrophytes, topographic features, live bottoms, *Sargassum*, chemosynthetic communities, and deepwater benthic communities.

Water Column

The GOM is divided into coastal and offshore waters. Coastal waters include all bays and estuaries from the Rio Grande River to Florida Bay. Offshore water includes both State offshore water and Federal OCS waters extending from outside the barrier islands to the EEZ. The inland extent is defined by the CZMA. Offshore waters are divided into three regions: the continental shelf west of the Mississippi River; the continental shelf east of the Mississippi River; and deep water (>1,000 ft; 305 m).

The U.S. portion of the GOM region follows the coastline of five states, from the southern tip of Texas moving eastward through Louisiana, Mississippi, Alabama, and ending in the Florida Keys. Including the shore of all barrier islands, wetlands, inland bays, and inland bodies of water, the combined coastlines of these states total over 47,000 miles (mi) (75,639 kilometers [km]) (USDOC, NOAA, 2008). The GOM coastal areas comprise over 750 bays, estuaries, and sub-estuary systems that are associated with larger estuaries (USEPA, 2012). More than 60 percent of U.S. drainage, including outlets from 33 major river systems and 207 estuaries, flows into the GOM (USEPA, 2014) and has a large influence on water quality. The largest contributing flows from the U.S coast are from the Mississippi and Atchafalaya Rivers in Louisiana. Additional freshwater inputs into the GOM originate in Mexico, the Yucatán Peninsula, and Cuba.

The physical oceanography of the deep GOM can be approximated as a 2-layer system with an upper layer about 2,625- to 3,281-ft (800- to 1,000-m) deep that is dominated by the Loop Current and associated clockwise (anticyclonic) eddies; and the lower layer below ~3,281 ft (1,000 m) that has near uniform currents (Welsh et al., 2009; Inoue et al., 2008). Deep waters east of the Mississippi River are affected by the Loop Current and associated warm-core anticyclonic eddies, which consist of clear, low-nutrient water (Muller-Karger et al., 2001). Cold-core cyclonic eddies also form at the edge of the Loop Current and are associated with upwelling and nutrient-rich, high-productivity waters.

Water quality is a term used to describe the condition or environmental health of a waterbody or resource, reflecting its particular biological, chemical, and physical characteristics and the ability of the waterbody to maintain the ecosystems it supports and influences. It is an important measure for both ecological and human health. The primary factors influencing coastal and offshore environments are temperature, salinity, dissolved oxygen, chlorophyll content, nutrients, potential of hydrogen (pH), oxidation reduction potential (Eh), pathogens, transparency (i.e., water clarity, turbidity, or suspended matter), and contaminant concentrations (e.g. heavy metals, hydrocarbons, and other organic compounds).

Surface water temperatures in the GOM vary seasonally from about 84 ºF (29 ºC) in the summer to about 65 ºF (19 ºC) in the winter (Gore, 1992). The salinity at the sea surface in the offshore GOM is generally 36 parts per thousand (Gore, 1992). Lower salinities are characteristic nearshore where fresh water from the rivers mixes with shallow GOM waters. There is a surface turbidity layer associated with the freshwater plumes from the Mississippi and Atchafalaya Rivers due to suspended sediment in river discharge, especially during seasonal periods of heavy precipitation. Outside of these areas, water clarity in the GOM is good to excellent, with low levels of suspended sediment. During summer months, shelf stratification results in a large hypoxic zone on the Louisiana-Texas shelf in bottom waters (Turner et al., 2005). The hypoxic zone in the GOM occurs seasonally and is influenced by the timing of the Mississippi and Atchafalaya River discharge, and the formation of the zone is attributed to nutrient influxes and shelf stratification; the zone persists until wind-driven circulation mixes the water column.

Anthropogenic factors that affect coastal water quality include urban runoff carrying oil and trace metals, agricultural runoff carrying fertilizer (e.g., nutrients including nitrogen and phosphorus), pesticides, and herbicides; upstream withdrawals of water for agricultural, industrial, and domestic purposes; and contamination by industrial and sewage discharges, dumping, air emissions, and spills of oil and hazardous materials. Mixing or circulation of coastal water can either improve water quality through flushing or be the source of factors contributing to its decline.

Offshore waters, especially deeper waters, are more directly affected by natural seeps; hydrocarbons enter the GOM through these natural seeps. Natural seeps are extensive throughout the continental slope of the GOM and are the highest contributor of petroleum hydrocarbons to the offshore environment. Pelagic tar is a common form of hydrocarbon contamination present in the offshore environment of the GOM. The USEPA's National Coastal Condition Report categorizes coastal waters of the United States based on an evaluation of five indices – water quality, sediment, benthic, coastal habitat, and fish tissue contaminants. The overall condition of coastal waters within the Gulf Coast is rated as fair (USEPA, 2012).

More specifically, the water quality index for the GOM's coastal waters was rated fair; the benthic index was rated fair to poor; the sediment quality and coastal habitat indices were rated poor; and the fish tissue contaminants index was rated good (USEPA, 2012). Of the evaluation indices listed, sediment quality (ranked as poor) poses an impact risk to coastal water quality as contaminants in sediments may be re-suspended into the water by anthropogenic activities, storms, or other natural events. Sediments in the GOM coastal region have been found to contain pesticides, metals, polychlorinated biphenyls, and occasionally polycyclic aromatic hydrocarbons (USEPA, 2012).

Gulf Stream

The Loop Current and its associated eddies create a dynamic zone with strong divergences and convergences that concentrate and transport organisms (this includes larvae from both oceanic and continental shelf species).

Estuarine

Wetlands

In general, coastal wetland habitats occur as bands around waterways. They are broad expanses of saline, brackish, and freshwater marshes; mud and sand flats; cypress-tupelo and mangrove swamps; and bottomland hardwood forests. Saline and brackish habitats support sharply delineated and segregated stands of single plant species. Fresh and low-salinity environments support more diverse and mixed communities of plants. High productivity and efficient nutrient recycling are characteristic of coastal wetlands. These wetland corridors also function as floodwater retention and purification areas and sites for local aquifer recharge. Different wetland habitats include the Laguna Madre (Texas), the Chenier Plain (Louisiana), the Mississippi River Delta Complex (Louisiana), the Pascagoula River delta and Mississippi Sound (Mississippi/Alabama), and the Big Bend (Florida). These are important areas for many estuarine-dependent species.

Seagrass Communities/Aquatic Macrophytes

Submerged vegetation distribution and composition depend on an interrelationship among a number of environmental factors that include water temperature, depth, turbidity, salinity, turbulence, and substrate suitability (Kemp, 1989; Onuf, 1996; Short et al., 2001). Seagrasses and freshwater submerged aquatic vegetation can function as a nursery habitat and as an adult habitat for sunfish, killifish, immature shrimp, crabs, drum, trout, flounder, and several other nekton species, and can provide a food source for species of wintering waterfowl and megaherbivores (Rozas and Odum, 1988; Rooker et al., 1998; Castellanos and Rozas, 2001; Heck et al., 2003; Orth et al., 2006). These habitats are found in some capacity throughout the GOM.

Structural Habitats

Oysters

Oysters are unique because they are a substrate and a fisheries species. They provide hard substrate with complex structure for inshore species, including other oysters (all structure provides hiding places/refuge). They are also an important prey species and are discussed later in this document. In the coastal areas off the United States, the oyster reefs in the GOM were identified as the only place left in the world where large-scale reef conservation and a sustainable fishery could exist (Beck et al., 2011).

Live Bottoms (Pinnacle Trend and Low Relief)

Although pinnacles can occur across the GOM and are protected as PSBFs, the northeastern central portion of the GOM includes a region with a large concentration of high topographic relief features collectively known as the “Pinnacle Trend.” This area is located at the outer edge of the Mississippi-Alabama shelf between the Mississippi River and De Soto Canyon. The Pinnacle Trend spreads over a 64 x 16 mi area (103 x 26 km) in water depths of 200-650 ft (60-200 m). High-relief features include pinnacles, flat-top reefs, reef-like mounds, patch reefs, and isobath-parallel ridges. Low-relief features include fields of small seafloor mounds that rise only a meter or two from the seafloor but provide exposed hard surfaces for encrusting and attached epifauna such as corals and sponges.

Low-relief features are also protected across the GOM; however, the inner and middle Mississippi-Alabama shelf has a high concentration of low-relief habitats, including fields of small seafloor mounds that rise only about 3-6 ft (1-2 m) from the seafloor but provide hard surfaces for encrusting and attached epifauna. This also includes isolated low-relief, reef-like structures; rubble fields; low-relief flat rocks (e.g., 20 ft long and 2 ft thick [6 m long and 0.6 m thick]); limestone ledges (e.g., 13 ft [4 m] high); rocky outcrops off Mobile Bay (59- to 131-ft [18- to 40-m] depth range; 16 ft wide and 7 ft high [5 m wide and 2 m high]); and clustered reefs (e.g., tens of meters across and 10 ft [3 m] high) (Schroeder et al., 1988; Schroeder, 2000). Hard bottom features on the Mississippi-Alabama-Florida Shelf typically provide reef habitat for tropical organisms, including sessile epifauna (i.e., soft corals, nonreef-building hard corals, sponges, bryozoans, and crinoids) and fish; these areas are typically of low relief (<3 ft; 1 m) (Thompson et al., 1999). Hard bottom areas include De Soto Canyon, Florida Middle Grounds, Pulley Ridge, Steamboat Lumps, Madison Swanson, and the Sticky Grounds. Other low-relief live bottoms include seagrass communities and are covered in the “Estuarine” section above.

Topographic Features

Topographic features are hard bottom habitats and are rare compared with the ubiquitous soft bottoms in the GOM (Parker et al., 1983). They are typically upthrusts of rock due to uplift (salt diapirs) by underlying layers of salt deep under the seafloor. Some others, such as the South Texas Banks, are relic coral reefs left over from the last sea-level low stand (about 10,000 years ago) or fossilized shorelines. These topographic highs, or subsea banks, provide hard substrate among expansive areas of soft bottoms.

Sargassum *Communities*

Pelagic *Sargassum* algae are one of the most ecologically important brown algal genera found in the pelagic environment of tropical and subtropical regions of the world. *Sargassum* is ubiquitous in surface waters throughout the GOM. The pelagic complex in the GOM is mainly comprised of *S. natans* and *S. fluitans* (Stoner, 1983; Lee and Moser, 1998; Littler and Littler, 2000). Both species of macrophytes (aquatic plants) are hyponeustonic (living immediately below the surface) and fully adapted to a pelagic existence (Lee and Moser, 1998). *Sargassum* serves as nurseries, sanctuaries, and forage grounds for both commercially and recreationally exploited species.

Deepwater Benthic Communities

Chemosynthetic Communities

Chemosynthetic communities use a carbon source independent of photosynthesis, typically converting hydrocarbons into a source of carbon. Chemosynthetic bacteria can support assemblages of higher order organisms through symbiotic relationships. Chemosynthetic bacteria live within the tissues of tube worms and bivalves and provide a food source for these hosts. Chemosynthetic byproducts can lead to the creation of authigenic carbonate substrates that can be further colonized by other organisms including deepwater corals and coral associates. Many communities dominated by chemosynthetic organisms have been confirmed in the GOM to date; more may exist around known seeps that have not yet been visually surveyed (http://www.boem.gov/Seismic-Water-Bottom-Anomalies-Map-Gallery/; [seep_anomaly_confirmed_organisms]).

Deepwater Coral Communities

Deepwater coral communities are relatively rare in the GOM, surviving on hard substrates across the GOM continental slope that are generally unfavorable for coral development. Corals dependent on photosynthetic algae (zooxanthellate) cannot live in aphotic deepwater environments; however, a number of other azooxanthellate corals do live on suitable hard substrates (hardgrounds) in deep waters throughout the GOM, including some scleractinian corals such as *Lophelia pertusa*. Deepwater corals may attach to any type of available hard substrate and are often found in association with high-density chemosynthetic communities. At least 45 communities dominated by deepwater coral species, with lesser presence at many additional sites, have been confirmed.

Habitat Areas of Particular Concern

The Habitat Areas of Particular Concern (HAPCs) are localized areas of EFH that are ecologically important, sensitive, stressed, or a rare area as compared with the rest of a species' EFH geological range. The HAPCs, as currently designated by the Gulf of Mexico Fishery

Management Council (GMFMC) and NMFS, are the East and West Flower Garden Banks, Stetson Bank, Rankin Bank, Bright Bank, 29 Fathom Bank, 28 Fathom Bank, MacNeil Bank, Geyer Bank, McGrail Bank, Sonnier Banks, Alderdice Bank, Jakkula Bank, Madison Swanson, Florida Middle Grounds, Pulley Ridge, and Tortugas Ecological Reserve. New HAPCs or revisions to HAPC boundaries can be made by the GMFMC and NMFS as new information becomes available.

Manmade Structures

While these are not identified or described by the NMFS as EFH, manmade structures serve as important habitat for many species. When manmade reefs are constructed, they provide new hard substrate similar in function to newly exposed hard bottom, with the additional benefit of substrate extending from the bottom to the surface. Reef structures of high profile seem to yield generally higher densities of managed and nonmanaged pelagic and demersal species than a more widespread, lower profile natural hard bottom or reef. Wilson et al. (2003) reported fish densities as much as 1,000 times larger on platforms compared with surrounding mud bottom habitats and even equal to or greater than natural reef habitats such as the Flower Garden Banks. The benefits of artificial reefs created by the installation of energy production platform structures are well documented in GOM waters off the coasts of Texas and Louisiana. More than 400 oil and gas platforms have been redeployed as artificial reef substrate after decommissioning (USDOI, BSEE, 2015). Jetties provide hard substrate for intertidal species and active OCS oil- and gas-related infrastructure (i.e., platforms, pipelines, and subsea systems) can create artificial hard substrate habitat for offshore species.

4 FISHERIES SPECIES

The GOM is identified as EFH for species managed by the GMFMC and is covered in the Shrimp Fishery Management Plan (FMP), Red Drum FMP, Reef Fish FMP, Spiny Lobster FMP, Coral and Coral Reef FMP, and Coastal Migratory Pelagic FMP. The highly migratory species managed by the NMFS (these species continue to have EFH designations extending in some cases to the Exclusive Economic Zone) also have EFH identified in the GOM. Many of these species are of commercial importance and all of them spend a portion of their life cycle within the waters of the GOM. The NMFS lists the species, EFH categories and designations, and HAPC in their *Essential Fish Habitat: A Marine Fish Habitat Conservation Mandate for Federal Agencies; Gulf of Mexico Region* (USDOC, NMFS, 2010). The following is summarized from the Gulf of Mexico Fishery Management Council's *Final Environmental Impact Statement; Generic Essential Fish Habitat Amendment to the Following Fishery Management Plans of the Gulf of Mexico: Shrimp Fishery of the Gulf of Mexico, Red Drum Fishery of the Gulf of Mexico, Reef Fish Fishery of the Gulf of Mexico, Stone Crab Fishery of the Gulf of Mexico, Coral and Coral Reefs of the Gulf of Mexico, Spiny Lobster in the Gulf of Mexico and South Atlantic, Coastal Migratory Pelagic Resources of the Gulf of Mexico and South Atlantic* (GMFMC, 2004) and the *Final Amendment 1 to the 2006 Consolidated Atlantic Highly Migratory Species Fishery Management Plan, Essential Fish Habitat* (USDOC, NMFS, 2009). For the full list of species and their scientific names, refer to **Table 1**.

Red Drum

Red drum use estuaries from Vermilion Bay, Louisiana, to eastern Mobile Bay, Alabama, to 25 fathoms (150 ft; 46 m) in Florida and between Crystal River to Naples, Florida, at 5-10 fathoms (30-60 ft; 9-18 m) and Cape Sable, Florida, to the boundary of Gulf of Mexico Fishery Management Council and South Atlantic Fishery Management Council. Red drums occur all over the GOM from the estuaries to 131 ft (40 m) offshore, and they can tolerate wide salinity ranges. Red drum eggs are found nearshore and larvae are in estuaries in temperatures of 77 °F (25 °C) during the later summer and early fall. Larvae feed on copepods. Early juveniles use nearshore estuarine areas and bays in the early winter and eat a variety of prey. Adults are found from the estuaries to the continental shelf in the fall and are omnivores. Spawning occurs nearshore in deeper waters by mouths of bays and inlets, and on the GOM side of barrier islands in the fall.

Reef Fish

Many reef fish use estuarine nursery habitat (i.e., sheltered bays, wetlands, and seagrass beds), although some species' larvae remain in open water or are associated with *Sargassum*. Late juveniles and adults opportunistically occupy pelagic and benthic portions of the GOM, frequently exhibiting preference for shelf habitat with moderate to high relief, such as topographic features and artificial substrates (e.g., ship wrecks and artificial reefs). Reef fish species demonstrate a general tendency for older, larger individuals to move into deeper waters toward the shelf edge. However, generalizations may not accurately reflect habitat usage by individual species and different life history stages in the GOM. For a list of reef fish species and their associated EFH, refer to **Table 2**.

Coastal Migratory Species

Coastal migratory species generally have pelagic eggs and larvae, with juveniles common in estuaries and nearshore waters. Spawning occurs over mid- or inner-continental shelf. The habitat locations for these species can be found in **Table 3**.

Shrimp

Shrimp generally spawn offshore and have demersal eggs and pelagic larvae. Larval shrimp feed on algae and zooplankton (**Table 4**). Post-larvae are found in nearshore and estuarine waters and become benthic. Juveniles are in estuaries, are omnivores, and eventually emigrate offshore.

Spiny Lobster

Spiny lobsters are found offshore in association with coral reefs and seagrass beds. Their larvae eat plankton and move from offshore to inshore. Juveniles use nearshore bays with macroalgae, sponges, and corals; they feed on invertebrates. Adults are found offshore in association with reefs, rocky habitat, and hard bottom, and they spawn offshore in reef fringes. Adults can also be found in seagrass beds within bays and feed on invertebrates.

Corals

Corals reproduce both asexually (through localized cloning of existing colonies) or sexually via broadcast spawning of larvae (or male gametes in the case of brooding), enabling long-distance dispersion that creates genetic links between regions (Veron, 2013; USDOC, NOAA, 2015). In the GOM, the primary locations of shallow-water zooxanthellate corals are the Flower Garden Banks, Florida Middle Grounds, and the Dry Tortugas. Deepwater azooxanthellate corals occur on isolated hard substrates throughout the GOM.

Highly Migratory Species

Highly Migratory Species include tunas, oceanic sharks, swordfish, and billfishes, representing a diverse group of species with a wide range of EFH, extending from the GOM into the Caribbean and up the U.S. Atlantic Coast (USDOC, NMFS, 2006). Adult distribution varies seasonally in the GOM and these fishes are commonly associated with hydrographic features. Boundaries between water masses, such as the Mississippi River plume, and frontal boundaries of the Loop Current and gyres are habitats that may host higher densities. Some species are also associated with waters overlying topographic features, such as the Pinnacles and the abundance of fisheries in De Soto Canyon. Oceanic sharks occupy a range of habitats and have been known to use estuaries, coastal, neritic, and offshore pelagic environments. **Tables 5 and 6** provide descriptions of where these species could be found in the GOM. In many of the descriptions, the Gulf Coast States are used to provide a reference point for approximately where in the GOM the species could occur. The following information can be found in detail in *Final Amendment 1 to the 2006 Consolidated Atlantic Highly Migratory Species Fishery Management Plan, Essential Fish Habitat* (USDOC, NMFS 2009). The NMFS has designated a vast area of the western GOM for Atlantic bluefin tuna as a HAPC; this species is found in both the GOM and the Atlantic Ocean (USDOC, NMFS, 2009). Although information is still scarce for the smalltail shark, bigeye sixgill shark, sevengill shark, sixgill shark, and whale shark, studies have provided sufficient information to update life history descriptions for most of these species and EFH boundaries based on distribution data collected since 2009 (USDOC, NMFS, 2015).

Other Species of Importance

Mullets use coastal waters, estuaries, and rivers; they have wide salinity and depth (3-393 ft; 1-120 m) ranges. Their eggs are planktonic and are found offshore. Larvae are pelagic and migrate inshore by entering through estuaries, and they feed on zooplankton. Juveniles use estuaries and are found in the mud and sand, and they feed on detritus and algae. Adults are found in estuaries and rivers over mud and sand bottoms and with vegetation. They spawn during the fall, winter offshore in large schools, and return to the estuary after they spawn.

Gulf menhaden are estuarine dependent, pelagic, and schooling planktivores that occur at depths from 3 to 459 ft (1 to 140 m). Eggs are pelagic and are found both inshore and offshore. Larvae are passively transported into estuaries and associate with lower salinities. Juveniles are found in nonvegetated areas and move to more saline bays with size. Adults are found in nearshore waters in bays (<59 ft; 18 m) and spawn over the shelf in the fall and winter.

Blue crabs are found all over the GOM depending on the life history stage. Eggs are attached to females that occur in high-salinity waters by barrier islands or bay mouths. Larvae (zoeae) are pelagic and are carried offshore to develop over the shelf. Post-larvae (megalope) migrate to estuaries and settle in vegetation and shoreline habitat; they are omnivores. Juveniles use vegetated habitats with mud and sand bottoms, and they have a wide salinity range. Adults are found in the same areas as juveniles, but females are generally found in higher salinities.

Oysters are found in inshore waters. Eggs are demersal, but oyster larvae are free swimming until their foot forms. During spatfall, oyster larvae sink to the bottom and settle on hard substrate. The oyster life cycle is all dependent on salinity cues. Adults grow attached to the substrate and are filter feeders. Oysters are planktivorous and broadcast spawners. They release eggs and sperm during the spring to the fall in warm, high-salinity waters.

Though two protected fish species (Gulf sturgeon [*Acipenser oxyrhynchus desotoi*] and smalltooth sawfish [*Pristis pectinata*]) are found in the GOM, they inhabit and have critical habitat in onshore waters. These species are not considered to be impacted by a proposed action because they are found away from activities that could cause an impact.

5 IMPACTS OF ROUTINE ACTIVITIES

Routine operations continue during the life of a lease, and different activities can have different effects on EFH. Generally, the activities would start with seismic surveys. The impact-producing factors associated with routine G&G activities include noise from various seismic surveys and bottom disturbances related to coring or node placement. Exploration and delineation wells are drilled to find and help define the amount of resource or the extent of the reservoir. Development wells are then drilled from movable structures, fixed bottom-supported structures, floating vertically moored structures, floating production facilities, and drillships. Any drilling will cause some sort of bottom area disturbance and sediment displacement. Some exploration drilling, platform, and pipeline emplacement operations on the OCS require anchors to hold the rig, topside structures, or support vessels in place. Anchors disturb the seafloor and sediments in the area where dropped or emplaced. Drilling muds and cuttings, and produced waters occurring with production and development are discharged, but they are subject to regulation by the USEPA. Over the past several decades, a mature pipeline network has been constructed in the GOM to transport produced oil and gas from the OCS to shore. Once a lease has expired, the lessee must sever bottom-founded structures and their related components at least 15 ft (5 m) below the mudline to ensure that no obstructions remain that could interfere with future lessees and other activities in the area. At the end of life, OCS structures are decommissioned. Nonexplosive severance methods include abrasive cutters, mechanical cutters, and diamond wire cutters. Explosive methods minimize the potential risk to humans and may be used to sever piles, but these methods may result in possible impacts to fisheries species and EFH. Not all of the routine actions are offshore. There are also coastal routine operations that can affect EFH, which include the following: service bases; gas processing plants; coastal pipelines; navigation channels; and disposal facilities for operations (discharge and wastewater).

Water Column

The primary impacting sources to water quality in coastal waters are point-source and storm-water discharges from support facilities, vessel discharges, and nonpoint-source runoff. These activities are not only highly regulated but also localized and temporary in nature. During exploration activities, the primary impacting sources to offshore water quality are discharges of drilling fluids and cuttings. During platform and pipeline installation and removal activities, the primary impacting sources to water quality are sediment disturbance and temporarily increased turbidity. Impacting discharges during production activities are produced water and service-vessel discharges, which might include water with an oil concentration of approximately 15 parts per million as established by regulatory standards. The USEPA and USCG's regulations are in place to limit the toxicity of the ingredients, the levels of incidental contaminants in these discharges, and in some cases the discharge rates and discharge locations. Any disturbance of the seafloor would increase turbidity in the surrounding water, but the increased turbidity should be temporary and restricted to the area near the disturbance. For decommissioning there would be no additional direct biological impacts. There are multiple Federal regulations and permit requirements that would decrease the magnitude of the impacts of these activities.

Estuarine

Wetlands

Overall, the impacts to wetlands from routine activities associated with a proposed action are not expected to adversely alter the protective barrier beach configurations much beyond existing, ongoing impacts in localized areas. This is because of the small amount of dredging, small probability of pipeline landfall, and no new onshore facilities expected as part of a proposed action. If any such activities should occur, multiple Federal and State regulations would ensure decreased impacts to coastal habitats.

Seagrass Communities/Aquatic Macrophytes

Routine OCS oil- and gas-related activities in the GOM that may impact seagrasses include maintenance dredging, vessel traffic, and pipeline landfalls. These activities are not expected to significantly increase in occurrence and range in the near future. If they do occur, these activities should have minor effects on submerged vegetation. This is because of Federal and State requirements and implemented programs, along with the beneficial effects of natural flushing (e.g., from winds and currents). Any potential effects on submerged vegetation from routine activities are expected to be localized.

Live Bottoms (Pinnacle Trend and Low Relief)

Oil and gas operations discharge drilling muds and cuttings, which generate turbidity, potentially smothering benthos near the drill sites. Deposition of drilling muds and cuttings in the Pinnacle Trend area would not greatly impact the biota of the live bottoms because the biota surrounding the pinnacle features are adapted to the turbid (nepheloid) conditions and high sedimentation rates associated with the outflow of the Mississippi River (Gittings et al., 1992). The pinnacles themselves are often coated with a veneer of sediment. The toxicity of produced waters has the potential to adversely impact the live-bottom organisms of the Pinnacle Trend. However, based on the localized impacts of routine OCS oil- and gas-related activities, the distance of the Pinnacle Trend from the proposed lease sale area, and the depth of the proposed lease sale area in relation to the depth where Pinnacle features are found, no impacts from routine events are anticipated to occur to Pinnacle Trend features as a result of a proposed activity.

The potential impacts from routine operations on low-relief live bottoms would be similar to the potential impacts to the Pinnacle Trend features. The toxicity of produced waters has the potential to adversely impact live bottom organisms. However, the closest Live Bottom Stipulation block is away from the proposed lease sale area, which eliminates the effects of routine impacts (from anchoring, infrastructure emplacement, drilling-effluent and produced-water discharges, and infrastructure removal) that could otherwise affect low-relief, live bottom features. Because the greatest impacts of routine OCS oil- and gas-related activity are reported close to the well and because the discharge of drilling muds, cuttings, and produced waters is strictly regulated by the USEPA's National Pollutant Discharge and Elimination System (NPDES) permits, routine discharges are not expected to reach low-relief, live bottom features. There will be no positioning of seafloor acoustic/electromagnetic equipment within these protected areas.

As for decommissioning, the shock waves produced by explosive severance activities could harm the biota of the deepwater benthic communities. However, corals and other sessile invertebrates typically have a high resistance to explosion-related shock waves. In addition, BSEE's regulations protect hard substrate features from explosive structure removal by reducing shock impact.

Topographic Features

The Topographic Features Stipulation would prevent most of the potential impacts on topographic features from bottom-disturbing activities (i.e., structure emplacement and removal) and operational discharges associated with a proposed action. Because the greatest impacts of routine OCS oil- and gas-related activity are reported close to the well and because the discharge of drilling muds, cuttings, and produced waters is strictly regulated by the NPDES permits, routine discharges are not likely to reach the topographic features. There will be no positioning of seafloor acoustic/electromagnetic equipment within these protected areas.

As for decommissioning, the shock waves produced by explosive severance activities could harm the biota of deepwater benthic communities. However, corals and other sessile invertebrates typically have a high resistance to explosion-related shock waves. In addition, BSEE's regulations protect topographic features from explosive structure removal by reducing shock impact.

***Sargassum* Communities**

All types of discharges, including drill muds and cuttings, produced water, and operational discharges (e.g., deck runoff, bilge water, and sanitary effluent) would contact a small portion of the *Sargassum* algae. However, the toxicity, quantity, and volume of these discharges within the proposed lease sale area is minor compared with the pelagic waters of the GOM, and it is regulated by the USEPA. Therefore, although discharges would contact *Sargassum*, they would only contact a very small portion of the *Sargassum* population. Drilling operations create an area of high turbidity in the vicinity of drill operations where cuttings are discharged. Impacts from sedimentation to these organisms may include "changes in respiration rate, abrasion and puncturing of structures, reduced feeding, reduced water filtration rates, smothering, delayed or reduced hatching of eggs, reduced larval growth or development, abnormal larval development, or reduced response to physical stimulus" (Anchor Environmental CA, L.P., 2003). Likewise, impingement or damage by service vessels and working platforms and drillships would contact only a very small portion of the *Sargassum* population.

Runoff water from the decks of ships and platforms may contain small quantities of oil, metals, and other contaminants. Larger vessels and offshore platforms discharge effluents from sanitary facilities (gray water). They also circulate seawater to cool ship's engines, electric generators, and other machines. The cooling water discharge may be up to 20 °F (11 °C) warmer than the surrounding seawater (USDHS, CG and USDOT, MARAD, 2003). This temperature difference can accumulate in the vicinity of the discharge. For oil and gas platforms and drillships, localized warming of the water could occur (Emery et al., 1997; USDHS, CG and USDOT, MARAD, 2003). However, the effects from gray water, deck runoff, and cooling water are only notable for stationary locations. Produced waters from stationary locations are rapidly diluted and impacts are only observed within 328 ft (100 m) of the discharge point (Sauer, 1991; Trefry et al., 1995; Gittings et al., 1992). Those effects are localized, with only brief contact to passing *Sargassum* before dilution to background levels. These effects would comprise a negligible portion of the overall cumulative impact to *Sargassum* communities.

The impacts to *Sargassum* that are associated with a proposed action are expected to have only minor effects to a small portion of the *Sargassum* community as a whole. The *Sargassum* community in the GOM is part of a larger cycle that reaches from the Sargasso Sea to the Caribbean, as such would be resilient to any localized, minor effects because it is constantly replaced in any given area (Frazier et al., 2015). There are no additional direct impacts from decommissioning. No measurable impacts are expected to the overall population of the *Sargassum* community.

Deepwater Benthic Communities

Chemosynthetic and deepwater coral communities are susceptible to physical impacts from anchoring, structure emplacement, pipeline installation, structure removal, and drilling discharges. Adherence to the guidance described in NTL 2009-JOINT-G40 greatly reduces the risk of these physical impacts by requiring that bottom-disturbing activities are distanced from potential deepwater benthic communities. Routine operations of a proposed action are expected to cause no damage to the ecological function or biological productivity of deepwater benthic communities. Widely scattered, high-density deepwater benthic communities would not be expected to experience significant impacts from OCS oil- and gas-related activities in deep water because the impacts would be limited by standard BOEM protections, as described in NTL 2009-JOINT-G40.

As for decommissioning, the shock waves produced by explosive severance activities could harm the biota of deepwater benthic communities. However, corals and other sessile invertebrates typically have a high resistance to explosion-related shock waves. In addition, BSEE's regulations protect features from explosive structure removal by reducing shock impact.

Fisheries Species

Routine activities such as pipeline trenching and OCS discharge of drilling muds and produced water could affect fish resources. It is expected that any possible coastal and marine environmental degradation from routine activities associated with a proposed action would cause a nondetectable decrease in fish resources. Regulations and mitigating measures reduce the initial impact of OCS oil- and gas-related activities associated impact-producing factors, such as the discharge of contaminants, physical damage to EFH, impaired physical or biological processes, or direct effects to fish resources. In addition, most GOM fisheries species are widely distributed throughout the GOM and into the Caribbean and/or western Atlantic waters. Impacts resulting from OCS oil- and gas-related activities are spatially limited and are expected to affect only a small portion of any population or EFH, resulting in a minimal decrease in fish resources and/or standing stocks.

Routine impact-producing factors that would have possible impacts to fisheries species include ensonification of the water column. All routine OCS oil- and gas-related activities have some element of sound generation. Common sound sources include propeller cavitation, rotating machinery, and reciprocating machinery, which are associated with routine OCS oil- and gas-related activities such as vessel traffic, drilling, construction, and oil and gas production, processing, and transport. Sound introduced into the marine environment as a result of human activities (anthropogenic sound) has the potential to affect marine organisms by stimulating behavioral response, masking biologically important signals, causing temporary or permanent hearing loss (Popper et al., 2005), or causing physiological injury resulting in mortality (Popper and Hastings, 2009). The potential for anthropogenic sound to affect any individual organism is dependent on the following: proximity to the source; signal characteristics; received peak pressures relative to the static pressure; cumulative sound exposure; species; motivation; and the receiver's prior experience. In addition, environmental conditions (e.g., temperature, water depth, and substrate) affect sound speed, propagation paths, and attenuation, resulting in temporal and spatial variations in the received signal for organisms throughout the ensonified area (Hildebrand, 2009).

Active acoustic sound levels from seismic survey activities that would have possible impacts to fisheries species are related to sound. Active acoustic sound levels can reach 230.7 dB re 1 µPa at 1 m sound pressure level for a large airgun array and 210.3 dB re 1 µPa at 1 m sound pressure level for a small array. Airguns generally have a frequency range of 10-2,000 hertz (Hz); however, most of the acoustic energy is radiated at frequencies below 200 Hz. In seismic airgun surveys, the sound source is constantly moving and intense sounds would possibly not be close enough to mobile adult or older juvenile individuals to inflict physiological damage due to a general tendency for fishes to react to airgun noise as evidenced in most studies, including those that were conducted in the activity intensive areas of the Barents Sea (Engås et al., 1996; Løkkeborg et al., 2012a and 2012b). The literature generally states that mortality or changes in pathology will occur in eggs and larvae that are found within 0-16 ft (0-5 m) of an airgun blast, with detrimental effects occurring close to the source. At distances of more than 33 ft (10 m), detrimental effects to fish eggs were detected only at very low levels (Turnpenny and Nedwell, 1994). There is little substantive data on whether the high sound levels of any anthropogenic sound would have physiological effects on invertebrates. Current evidence does not indicate that seismic activity will cause detrimental effects on populations of fish and invertebrates.

Existing evidence supports that anthropogenic noise could mask sounds of biological relevance to fish, particularly those whose predominant biological signals and best hearing frequencies occur below 500 Hz (Popper et al., 2003; Popper and Hastings, 2009; Slabbekoorn et al., 2010; Popper et al., 2014; Radford et al., 2014). Seismic airguns produce an impulse signal that could be expected to mask sounds within or near the limits of the airgun shot's spectral profile as it impinges on the fish, but only for up to 300 milliseconds prior to and following the shot. Masking occurs when background noise increases the threshold for a signal to be detectable. The results of some studies demonstrate a reduced responsiveness to test signals in fishes exposed to background noise exceeding typical ambient levels for extended periods. If detection thresholds are raised for biologically relevant signals, there is a potential for increased predation, reduced foraging success, reduced reproductive success, or other effects.

Temporary threshold shift (TTS) can occur when hearing damage causes decreased sensitivity to signals within a band of frequencies, resulting in an increase to the minimum sound level necessary for a signal to be detected. Although TTS could result from exposure to pulsed or continuous noise, continuous signals have been shown to cause a comparable TTS at lower sound levels than pulsed signals. Similar to masking, the resulting shift could impair the affected individual's ability to detect and respond to biologically relevant sounds. However, it may take hours or days for individuals to fully recover hearing sensitivity.

Electromechanical sources are considered mid- or high-frequency sources operating in the range from 200 Hz to 400 kilohertz. It is estimated that the impact of an operator's methods on fishery resources that are highly dependent on the utilization of electromagnetic sensory capabilities would be negligible because the operational frequency of the electromagnetic emissions are very low and the potential exposure times are very short (Buchanan et al., 2011).

For explosive severance, the underwater pressure signature of a detonation is composed of an initial shock wave followed by a succession of oscillating bubble pulses. The rapid oscillation in the pressure waveform associated with detonation is probably responsible for fish mortality seen at explosive removal sites because it causes rapid contraction and overextension of the swim bladder in fish. Invertebrates and fish without or with less developed swim bladders are resistant to underwater blasts. Any impact to fish resources or EFH is expected to be highly dependent upon the specific platform scheduled for removal and will be limited to a localized, temporary disruption.

6 IMPACTS OF ACCIDENTAL EVENTS

This is a summary of the effects of offshore and coastal spills that are reasonably foreseeable on EFH and fish resources. Although a catastrophic event is a low-probability event and not reasonably foreseeable nor reasonably certain to occur, there is also a summary of the potential effects of a catastrophic spill on each EFH and fish resources in BOEM's *Catastrophic Spill Event Analysis* White Paper (USDOI, BOEM, 2016).

Water Column

Accidental events associated with a proposed action that could impact coastal and offshore water quality include spills of oil and refined hydrocarbons, releases of natural gas and condensate, usage of chemical dispersants in oil-spill response, and spills of chemicals or drilling fluids. The loss of well control, pipeline failures, collisions, or other malfunctions could also result in such spills. Spills from collisions are not expected to be significant because collisions occur infrequently. Overall, loss of well control events are rare events and of short duration, so potential impacts to offshore water quality are not expected to be significant except in the rare case of a catastrophic event. Although response efforts may decrease the amount of oil in the environment, the response efforts may also impact the environment through, for example, increased vessel traffic, hydromodification, and application of dispersants. Natural degradation processes would also decrease the amount of spilled oil over time. For coastal spills, two additional factors that must be considered are the shallowness of the area and the proximity of the spill to shore. Over time, natural processes can physically, chemically, and biologically degrade oil. Chemicals used in the oil and gas industry are not a significant risk in the event of a spill because they are either nontoxic, used in minor quantities, or are only used on a noncontinuous basis. Although there is the potential for accidental events, a proposed action would not significantly change the water quality of the GOM over a large spatial or temporal scale outside of a catastrophic event.

Estuarine

Wetlands

Overall, impacts to wetland habitats from an oil spill associated with activities related to a proposed action would be expected to be low and temporary. This is because of the dynamic nature of the system, State and COE permit regulations, and specific cleanup techniques. Coastal spills, which are the most likely to affect wetlands, would be expected to be localized and smaller in scale and have a quick response.

Seagrass Communities/Aquatic Macrophytes

The greatest threat to inland, submerged vegetation communities would be from an inland spill resulting from a vessel accident or pipeline rupture, but the size of these types of spills is small and of duration short. The floating nature of nondispersed crude oil, the regional microtidal range, dynamic climate with mild temperatures, and the amount of microorganisms that consume oil would alleviate prolonged effects on submerged vegetation communities. Also, safety and spill-prevention technologies continue to improve and will decrease detrimental effects to submerged vegetation from a proposed action.

Live Bottoms (Pinnacle Trend and Low Relief)

Disturbances resulting from a proposed action, including oil spills and loss of well control, have the potential to disrupt and alter the environmental, recreational, and aesthetic values of the live bottom habitats. Live bottom (Pinnacle Trend) features represent a small fraction of the continental shelf area. The small portion of the seafloor covered by these features, combined with the probable random nature of oil-spill locations, serves to limit the extent of damage from any given oil spill to the Pinnacle Trend features. The depth below the sea surface to which the Pinnacle Trend features rise (130 ft [40 m] or more below the sea surface) helps to protect them from surface oil spills because disturbance of the sea surface by storms can mix surface oil into the water column, but the effects are generally limited to the upper 33 ft (10 m). In areas with known live bottoms, the Live Bottom (Pinnacle Trend) and Live Bottom (Low Relief) Stipulations protect the biota of live bottoms from most of the potential impacts from oil and gas operations, including accidental oil spills and loss of well control. Because of the estimated distance of a proposed action from the features, only large spills have the potential to reach the live bottom (low-relief) features. Also, operations outside the proposed buffer zones around sensitive habitats (including loss of well control and oil spills) may affect live bottom features.

A subsurface spill or plume may impact sessile biota of live bottom features. Oil or dispersed oil may cause lethal or sublethal impacts to benthic organisms if a plume reaches these features. Sedimented oil or sedimentation as a result of a blowout may also impact benthic organisms. Sublethal impacts may include loss of habitat, biodiversity, and live coverage; change in community structure; and failed reproductive success. Because of the distance from live bottoms, sedimented oil should be well dispersed, resulting in a light layer of deposition that would be easily removed by the organism and have low toxicity.

Topographic Features

On blocks with topographic features, the Topographic Features Stipulation may be implemented by BOEM to assists in preventing most of the potential impacts on topographic feature communities from loss of well control, surface and subsurface oil spills, and the associated effects by increasing the distance of such events from the topographic features. Because of the probable distance of a proposed action from the features, only large spills have the potential to reach the topographic features. In the unlikely event that oil from a subsurface spill would reach the biota of a topographic feature, the effects would be primarily sublethal and impacts would be at the community level. Any turbidity, sedimentation, and oil adsorbed to sediments would also be at low concentrations by the time the topographic features were reached, also resulting in sublethal impacts. Impacts from an oil spill on topographic features are also lessened by the distance of the spill, the depth, and the currents that surround the topographic features.

***Sargassum* Communities**

Pelagic *Sargassum* algae occur seasonally as a patchy resource in almost every part of the northern GOM, resulting in a wide distribution over a very large area. Considering its ubiquitous distribution and occurrence in the upper water column near the sea surface, potential accidental spills from oil and gas operations would be expected to contact localized portions of the *Sargassum* community. All types of spills (including surface oil and fuel spills), underwater loss of well control, and chemical spills would contact *Sargassum* algae. The quantity and volume of most of these spills would be relatively small compared with the pelagic waters of the GOM and the life cycle of *Sargassum*. Therefore, most spills would only contact a very small portion of the *Sargassum* population. The impacts to *Sargassum* that are associated with a proposed action are expected to have only minor effects to a small portion of the *Sargassum* community unless a catastrophic spill occurs. In the case of a very large spill, the *Sargassum* algae community could suffer severe impacts to a sizable portion of the population in the northern GOM. It has a yearly growth cycle that promotes quick recovery from impacts and that would be expected to restore typical population levels in 1-2 growing seasons. Because of the patchy and ephemeral nature of *Sargassum*, accidental impacts associated with a proposed action are expected to have only minor effects to a small portion of the *Sargassum* community as a whole.

Deepwater Benthic Communities

The most likely threat to chemosynthetic and deepwater coral communities is physical disturbance of the seafloor, which could destroy the organisms of these communities. The possibility of oil from a surface spill reaching a depth of 984 ft (300 m) or greater in any meaningful concentration is very small. Subsea oil plumes resulting from high-pressure subsea oil releases and/or the application of chemical dispersants have the potential to negatively affect chemosynthetic communities. If oil is ejected under high pressure or if dispersants are applied to an oil spill, oil would mix into the water column, be carried by underwater currents, and could eventually contact the seafloor where it may impact patches of chemosynthetic community habitat and deepwater corals in its path.

Most accidental events expected to be associated with a proposed action would result in only minimal impacts to deepwater benthic communities with adherence to the guidelines described in NTL 2009-JOINT-G40. One exception would be in the case of a catastrophic spill combined with the application of dispersant, producing the potential to cause devastating effects on local patches of habitat in the path of subsea plumes where they physically contact the seafloor, as was documented for a limited number of deepwater coral colonies following the *Deepwater Horizon* oil spill (White et al., 2012). The possible impacts, however, would be localized due to the directional movement of oil plumes by the water currents and because the sensitive habitats have a scattered, patchy distribution. Oil plumes that remain in the water column for longer periods would disperse and decay, having only a minimal effect.

Fisheries Species

Accidental events that could impact fisheries species include loss of well control and oil or chemical spills. Although a highly unlikely occurrence, loss of well control could suspend large amounts of sediment and has the potential to adversely affect fisheries species in the immediate area. If oil spills due to a proposed action were to occur in open waters of the OCS proximate to mobile adult fish, the effects would likely be nonfatal and the extent of damage would be reduced because adult fish have the ability to move away from unfavorable conditions, to metabolize hydrocarbons, and to excrete both metabolites and parent compounds. A small fish population with a spatially limited distribution could be impacted by an oil spill were the spill to occur within the species' range. However, impacts would primarily be limited to small portions of populations, with the greatest potential impacts occurring if oil reaches the shelf and estuarine areas, but the probability of a spill in these areas is low. Fish populations of the GOM have repeatedly proven to be resilient to large, annually occurring areas of hypoxia, major hurricanes, and oil spills. A proposed action is not expected to significantly affect fish populations in the GOM.

7 CUMULATIVE IMPACTS

The OCS Program, along with State oil and gas activities and other offshore activities including dredging and artificial reefs, will continue to affect offshore EFH. Many of the OCS oil- and gas-related activities have been covered in the "Impacts of Routine Activities" and "Impacts of Accidental Events" chapters above and are summarized in this chapter. This chapter will also consider other impacts such as natural disturbances and fishing.

Water Column

Water quality in coastal and offshore waters would be impacted by sediment disturbance and suspension (i.e., turbidity), vessel discharges, erosion, runoff from nonpoint-source pollutants (including river inflows), seasonal influences, and accidental events. Natural seeps and discharges from exploration and production activities are other potential impacting factors to offshore waters. The effects on water quality resulting from a proposed action are a small addition to the cumulative impacts (i.e., other Federal agencies, States, private vessels, increases in human population, and natural events or processes) on the waters of the GOM. Increased turbidity and discharge from a proposed action would be temporary in nature and minimized by Federal permit regulations and mitigation. Since a catastrophic accident is considered rare and not expected to occur in coastal waters, the impact of accidental spills is expected to be small. In offshore waters, degradation processes in both surface and subsurface waters would decrease the amount of spilled oil over time through natural processes that can physically, chemically, and biologically degrade oil (NRC, 2003). The effect on coastal water quality from smaller accidental spills is expected to be minimal relative to the cumulative inputs of hydrocarbons from other sources. The incremental contribution of the routine activities and accidental events associated with a proposed action to the cumulative impacts on coastal and offshore water quality is not expected to be significant as long as all regulations are followed.

Estuarine

Wetlands

Wetlands are most vulnerable to inshore or nearshore oil spills, but such spills are generally localized events. Spill sources include vessel collisions, pipeline breaks, and shore-based transfer, refining, and production facilities. There is a reduced risk of spills contacting wetlands because of the distance of offshore facilities to wetland sites, beach and barrier island topography, and product transportation through existing pipelines or pipeline corridors. If oil reaches wetlands, only light localized impacts to inland wetlands would occur.

While land loss will continue from subsidence and saltwater intrusion, the State of Louisiana and COE have implemented freshwater diversion projects to minimize the effect of this saltwater-induced land loss. This would cause a change in the type of EFH (i.e., wetlands to open water). A proposed action would not require any channel maintenance; therefore, no additional wetland loss would result from dredged material disposal. If dredged material disposal is required, it would likely be beneficially used for marsh creation. Though existing pipeline channels are estimated to continue to erode wetlands, estimates do not take into account the current regulatory programs and modern construction techniques and COE mitigations. Because of modern construction techniques and mitigating measures, there would be zero to negligible impacts on wetland habitats as a result of a proposed action.

The disposal of OCS wastes and drilling by-products would be delivered to existing facilities. Because of existing capacity, no additional expansion into wetland areas is expected. Development pressures in the coastal regions of Texas, Louisiana, Mississippi, Alabama, and Florida have caused the destruction of large areas of wetlands. In coastal Louisiana, the most destructive developments have been the inland oil and gas industry projects, which have resulted in the dredging of huge numbers of access channels. Agricultural, residential, and commercial developments have caused the most destruction of wetlands in Mississippi, Alabama, and Florida. In Texas and Florida, recreational and tourist developments have been particularly destructive. These trends are expected to continue.

The cumulative effects of human and natural activities in the coastal area have severely degraded the deltaic processes and have shifted the coastal area from a condition of net land building to one of net land loss. The incremental contribution of a proposed action to the cumulative impacts on coastal wetlands is expected to be small.

Seagrass Communities/Aquatic Macrophytes

Dredging and prop scarring from boats generate the greatest overall risk to submerged vegetation, while naturally occurring hurricanes cause direct damage to beds. The Federal and State permit mitigation policies that are currently in place, the small probability of an oil spill, and the natural flow regimes of coastal waters are not expected to change in the near future. These activities further reduce the incremental contribution of stress from a proposed action on submerged vegetation.

Live Bottoms (Pinnacle Trend and Low Relief)

Non-OCS oil- and gas-related activities that may occur in the vicinity of the Pinnacle Trend and low-relief live bottom communities include recreational boating and fishing, import tankering, fishing and trawling, and natural events such as tropical storms and other extreme fluctuations of environmental conditions. These activities could cause damage to live bottom communities. Large ships occasionally anchor in the general area of live bottoms, and anchoring recreational fishing vessels may actively target live bottom areas because of their association with desirable fish. Bottom-disturbing activities could lead to severe physical damage to individual features. During severe storms, bottom sediments can be stirred (Brooks, 1991; CSA, 1992), possibly causing negative impacts in shallower waters. Because of the depth of the Pinnacle Trend area, these forces are not expected to be strong enough to cause direct physical damage to most organisms living on those reefs. Yearly hypoxic events may affect portions of live bottom benthic populations in the northeastern central part of the GOM.

Possible impacts from OCS oil- and gas-related routine operations include anchoring, structure emplacement and removal, pipeline emplacement, drilling discharges, and discharges of produced waters. In addition, accidental subsea oil spills or loss of well control associated with OCS oil- and gas-related activities could cause damage to live bottom communities, but these impact-producing factors would be restrained by implementation of the lease stipulation and site-specific mitigations. Potential, localized impacts to the live bottom resource as a whole are expected to be negligible when such resources are considered on a regionwide scale. Potential impacts from discharges would be further reduced by the USEPA's discharge regulations and permits restrictions. The incremental contribution of a proposed action to the cumulative impact is expected to be negligible.

Topographic Features

The cumulative impact from routine and accidental oil and gas operations includes effects resulting from a proposed action, as well as those resulting from past and future OCS leasing. These operations include bottom-disturbing activities and accidental events. Because the proposed Topographic Features Stipulation has been in effect for decades, and is expected to remain in effect, it is assumed to be in effect for this analysis. The proposed Topographic Features Stipulation restricts these activities within 500 ft (152 m) of the No Activity Zone around topographic features, thus preventing adverse impacts on benthic communities of topographic features (USDOI, MMS, 2009).

Impacts on the topographic features could occur as a result of oil- and gas-related spills or other types of releases. To date, previous noncatastrophic spills have not had any identifiable impact on any topographic features. Any dispersed surface oil that may reach the benthic communities of topographic features in the GOM would be expected to be at a concentration low enough to have no discernable long-term impacts (<1 parts per million) (Lewis, 1971; Elgershuizen and De Kruijf, 1976; McAuliffe et al., 1981a and 1981b; Cook and Knap, 1983; Dodge et al., 1984; Wyers et al., 1986; Lewis and Aurand, 1997).

The potential impacts to topographic features from non-OCS sources include anchoring, fishing, hurricanes, damage by recreational scuba diving, and the presence of invasive species. Most of these features are deep enough that scuba diving activities are limited. In most areas where diving is possible, these activities are managed by other Federal agencies and protect habitats from modification or destruction.

Hurricanes are still considered a rare event at any given location; however, they are a natural event within the environment and these habitats have adapted to deal with these storms over millennia. As such, hurricanes may alter the environment and kill organisms, but these are not considered "impacts" because they remain a normal part of the life cycle of a topographic feature.

Because many of the topographic features are found near established shipping fairways and are well-known fishing areas, anchoring at a topographic feature by a vessel could and has damaged the biota. The degree of damage is dependent on the size of the anchor and chain (Lissner et al., 1991). Anchor damages incurred by benthic organisms may take more than 10 years to recover, depending on the extent of the damage (Fucik et al., 1984; Rogers and Garrison, 2001). The combined impact of anchoring activities on topographic features is unknown, but anchoring is only prohibited at three of the recognized topographic features.

Fishing pressure could alter fish community structure and potentially have a top-down regulatory impact on fish populations, ultimately impacting the benthic community. This could occur through the unsustainable harvest practices; however, most managed fish populations are stable or recovering. Harvest activities are managed and monitored by other Federal agencies, and populations are not expected to be depleted to a point where benthic populations are impacted. The recent invasion by lionfish may alter fish and invertebrate population on topographic features. The predatory nature of this fish, combined with the lack of natural predators, suggests that a population explosion of lionfish could result in a top-down impact of benthic organisms. The result would be a decrease in biodiversity and abundance of many of the smaller organisms that use the benthic habitats found on topographic features. Given the spread of reported lionfish sightings across the GOM, it is possible that they are present on all of the topographic features, but the impacts are still unknown as populations are still increasing exponentially (Switzer et al., 2015).

Given that all OCS oil- and gas-related anchoring activities have been and remain prohibited or regulated on and around topographic features and that siting restrictions minimize the potential for oil to contact topographic features in case of an accidental spill, the probability of an OCS oil- and gas-related action increasing the impact of any non-OCS oil- and gas-related activities is low.

***Sargassum* Communities**

Several impacting factors can affect *Sargassum*, including vessel-related operations, oil and gas drilling discharges, operational discharges, accidental spills, non-OCS vessel activity, and coastal water quality. Pelagic *Sargassum* floats at the surface in oceanic waters and is carried by surface currents across the GOM. Vessels transiting the GOM pass through *Sargassum* mats, producing slight impacts to the *Sargassum* community by their passage, some propeller impacts, and possible impingement impacts. None of these would have more than minor localized effects to the mats, but they could lead to the loss of plants or stress for organisms. Oil and gas structures can impede the movement of *Sargassum* mats and may entrap small quantities of the algae. This is expected to be a negligible impact with no consequences to the overall *Sargassum* community.

Oil and gas drilling results in discharges of drill cuttings with small quantities of associated drilling muds and well treatment chemicals. Most cuttings from well drilling are discharged from the drill platform at the sea surface where they disperse (CSA, 2006; Kennicutt et al., 1996; NRC, 1983). Floating mats of *Sargassum* that pass by a drilling operation would experience short-term exposure to drill cuttings with associated muds and well treatment chemicals. Drilling operations create an area of high turbidity in the vicinity of drilling operations where cuttings are discharged. The composition of muds is strictly regulated, and discharges of cuttings/muds are tested to ensure that toxicity levels are below the limits allowed by the NPDES permits (USEPA, 2004, 2007, and 2009). Impacts from an accidental release of oil could range from negligible to severe, including death if oil concentrations in the water column are great enough to result in ingestion of oil or coating of the organisms (Fucik et al., 1995; Brewton et al., 2013).

Runoff water from the decks of ships and platforms may contain small quantities of oil, metals, and other contaminants, including grey water. Cooling water from large ships may be up to 20 °F (11 °C) warmer than the surrounding seawater (USDHS, CG and USDOT, MARAD, 2003). However, the warm water is rapidly diluted, mixing to background temperature levels within 328 ft (100 m) of the source (USDHS, CG and USDOT, MARAD, 2003). Produced waters from stationary locations are localized, with only brief contact to passing *Sargassum* before dilution to background levels. These effects would comprise a negligible portion of the overall cumulative impact to *Sargassum* communities.

Accidental spills of oil and other chemicals could affect *Sargassum* and its community wherever they contact the algae. Small spills would have a limited local effect on a small portion of the *Sargassum* community. Short-term exposure of passing *Sargassum* to high concentrations of oil and chemicals could result in death and sinking of algae and organisms contacted. The size of the overall effect on *Sargassum* would depend on the size of the spill and the success of spill-response efforts.

For non-OCS oil- and gas-related activities, marine vessels of all types produce at least some minor effects to the environment; as such, an increased abundance of non-OCS vessels operating in the same environment as *Sargassum* presents an increase in the expected vessel-related damage to *Sargassum* and associated communities. Given that most vessels are limited to the waters nearshore (e.g., recreational fishermen), the expected effects on *Sargassum* is expected to be minor. *Sargassum* found in near-coastal waters is expected to eventually senesce or be deposited on coastal beaches. As such, additional damage to any *Sargassum* that may occur would not impact the population. These effects would also be more concentrated in areas near coastal passes; however, there is only a limited number of such coastal passes in the GOM. Offshore traffic would be limited and occur in a haphazard manner beyond shipping lanes. As such, the movement of *Sargassum* combined with the movement of vessels ensures that no impacts occur routinely to any given *Sargassum*, resulting in any cumulative effects by non-OCS vessel traffic to be negligible. Declining coastal water conditions are a non-OCS effect that could result in landscape-level impacts to *Sargassum*. Increased nutrient loading can lead to increased turbidity and a reduction in oxygen during periods of hypoxia (e.g., summer). Both of these could result in a decrease in *Sargassum* production and result in stress to the organisms inhabiting these habitats. A reduction in production could result in a decrease in the ability of *Sargassum* to sequester nutrients and carbon dioxide and to produce oxygen. The exact impact of declining water quality is unknown because *Sargassum* can pass in and out of these waters depending on the prevailing conditions and much of the more hypoxic and highly turbid waters occur nearshore where *Sargassum* would not normally survive because it would be deposited on a coastal beach or senesce and sink to the seafloor.

Because the *Sargassum* cycle occurs across a large portion of the western hemisphere (Frazier 2015) and because oil and gas operations rarely occur in dense aggregations, especially with respect to drilling operations, the cumulative effects of a proposed action on the population of *Sargassum* would be negligible. The effects of OCS oil- and gas-related operations combined with non-OCS factors would not result in an increase in the overall impact of oil and gas operations resulting from the proposed action. Non-OCS vessel traffic is not expected to have a substantial effect on *Sargassum* and associated communities; however, declining coastal water quality could. However, the incremental impact of OCS oil- and gas-related operations on water quality would be negligible as effects from changing water quality would occur regardless of the presence of OCS oil- and gas-related operations.

Deepwater Benthic Communities

Cumulative impacts to deepwater benthic communities in the GOM from sources other than OCS oil- and gas-related activities are considered negligible. The most serious, impact-producing factor threatening chemosynthetic and deepwater coral communities is physical disturbance of the seafloor, including activities associated with pipelaying, anchoring, structure emplacement, and loss of well control. Possible catastrophic oil spills have the potential to devastate localized deepwater benthic communities. However, these events are rare and would only affect a small portion of such communities in the GOM.

Activities unrelated to the OCS Program include fishing and trawling. Because of the water depths where deepwater benthic communities occur (>984 ft; 300 m), the low density of potentially commercially valuable fishery species, and protections enacted by the NMFS and GMFMC, fishing and trawling activities are not expected to have substantial impacts on deepwater benthic comminutes. Regional and global environmental changes attributed to greenhouse gas-driven climate change, such as changes in water temperature and ocean acidity levels, have the potential to alter deepwater benthic communities, but they are not expected to have major impacts in the near future.

The proposed activities considered under the cumulative scenario are not expected to cause damage to the ecological function or biological productivity of the Gulfwide population of deepwater benthic communities. Individual, localized communities could potentially experience isolated minor impacts from drilling discharges or resuspended sediments.

Fisheries Species

The OCS oil- and gas-related factors potentially impacting fisheries species in the GOM are federally regulated or mitigated and small. There are many anthropogenic factors that are regulated by Federal and State agencies, and natural factors that cannot be regulated. Also to be considered is the variability in GOM fish populations due to natural factors such as spawning success and juvenile survival. Overall, the incremental contribution of the OCS oil- and gas-related effects to fish populations is small.

Overfishing (including bycatch) has contributed significantly to the decline of some populations of GOM species in the past. The Magnuson-Stevens Fishery Conservation and Management Act and its amendments address sustainable fisheries and set guidelines for protecting marine resources and habitat from fishing- and nonfishing-related activities. The NMFS, as advised by the GMFMC, is responsible for managing fisheries in the GOM, including implementing catch limits, establishing seasons, and assessing stocks. Over the past few decades, efforts to end overfishing and rebuild overfished stocks have resulted in significant improvement to the populations of several fisheries species.

Naturally occurring tropical cyclones can cause damage to various EFH, both inshore (e.g., wetland loss) and offshore (e.g., damage to topographic features). However, these storms are a continual part of the GOM climate and should not be considered except under extraordinary circumstances.

All of these events and activities can affect EFH and fisheries species. Many anthropogenic inputs, including a proposed action, are now monitored, regulated, and mitigated by the permitting agency or State. These efforts are expected to continue in the future, and the restoration of habitats could increase with better technologies. While EFH and fish resources are impacted by these many factors, a proposed action would add minimally to the overall cumulative effects.

8 OVERALL GENERAL CONCLUSIONS

Water Column

The primary impacting sources to water quality in coastal waters are point-source and storm-water discharges from support facilities, vessel discharges, and nonpoint-source runoff. There are multiple Federal regulations and permit requirements that would decrease the magnitude of the impacts of these activities. Accidental events associated with a proposed action that could impact coastal and offshore water quality include spills of oil and refined hydrocarbons, releases of natural gas and condensate, usage of chemical dispersants in oil-spill response, and spills of chemicals or drilling fluids. Response efforts, along with natural degradation processes, also decrease the amount of spilled oil over time. The effects on water quality resulting from a proposed action are a small addition to the cumulative impacts (i.e., other Federal agencies, States, private vessels, increases in human population, and natural events or processes) on the waters of the GOM.

Estuarine

A loss of wetlands and associated biological resources (including submerged grass beds) could occur if these vegetated habitats are permanently lost because of impacts caused by dredging and construction activities that displace existing wetlands or from oil spills severe enough to cause permanent die-back of vegetation and conversion to open water. Construction and emplacement of onshore pipelines in coastal wetlands displace coastal wetlands in disturbed areas that are then subject to indirect impacts like saltwater intrusion or erosion of the marsh soils along navigation channels and canals, which can change estuarine vegetation and habitat type (e.g., more salt water-tolerant species moving into habitats that had freshwater species). Ongoing natural and anthropogenic processes in the coastal zone, only one of which is OCS-related activity, can result in direct and indirect loss of wetlands and continue to cause stress to submerged vegetation communities. Natural losses as a consequence of the coastal area becoming hydrologically isolated from the Mississippi River that built it, sea-level rise, and subsidence of the delta platform in absence of new sediment added to the delta plain appear to be much more dominant processes impacting coastal wetlands. These losses would change EFH from flooded vegetated habitat to open-water habitats.

Live Bottoms (Pinnacle Trend and Low Relief)

Oil and gas operations discharge drilling muds and cuttings that generate turbidity, potentially smothering benthos near the drill sites. Also, the toxicity of produced waters and contact with spilled oil can adversely impact the live bottom organisms. Because the greatest impacts of OCS oil- and gas-related activity are reported close to the well (away from live bottom features due to the stipulations and other mitigations applied at the postlease review), most activities would not have a high potential to impact live bottom features. The positioning of seafloor acoustic/electromagnetic equipment is also carefully reviewed and restricted near these protected areas.

Topographic Features

The Topographic Features Stipulation and the mitigations upheld with postlease reviews would prevent most of the potential impacts on topographic features from bottom-disturbing activities and operational discharges associated with a proposed action, as well as potential accidental oil spills. The positioning of seafloor acoustic/electromagnetic equipment is carefully reviewed and restricted near these protected areas.

***Sargassum* Communities**

The impacts to *Sargassum* that are associated with a proposed action are expected to have only minor effects to a small portion of the *Sargassum* community as a whole. The *Sargassum* community occupies pelagic waters with generally high water quality and would be resilient to the minor effects predicted. It has a yearly cycle that promotes quick recovery from impacts. No measurable impacts are expected to the overall population of the *Sargassum* community.

Deepwater Benthic Habitats

An irreversible loss or degradation of ecological habitat caused by cumulative activity from a proposed action tends to be incremental over the short term. Irretrievable loss may not occur unless or until a critical threshold is reached. It can be difficult or impossible to identify when that threshold is, or would be, reached. Oil spills and chronic low-level pollution can injure and kill organisms at virtually all trophic levels. Mortality of individual organisms can be expected to occur, and possibly a reduction or even elimination of a few small or isolated populations. The proposed biological stipulations, however, are expected to eliminate most of these risks.

Fisheries Species

The largest impacts to these fisheries resources from a proposed action would be the irreversible loss of fish and coral, including commercial and recreational species, caused by structure removal using explosive severance methods. Fish in proximity to an underwater explosion can be killed. Without the structure to serve as habitat, sessile, attached invertebrates and the fish that live among them may be absent. Structure removal eliminates temporary and local artificial habitats, potentially resulting in changes to the community in the restored area. Continued structure removal, regardless of the technique used, would reduce the net benefits to commercial and recreational fishing provided by the presence of these structures. However, when compared with natural habitat in the GOM, OCS oil- and gas-related structures contribute a very small amount of habitat.

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Table 1. Managed Species in the Gulf of Mexico.

Red Drum Fishery red drum (*Sciaenops ocellatus*) **Reef Fish Fishery** blackfin snapper (*Lutjanus buccanella*) cubera snapper (*Lutjanus cyanopterus*) gray snapper (*Lutjanus griseus*) lane snapper (*Lutjanus synagris*) mutton snapper (*Lutjanus analis*) queen snapper (*Etelis oculatus*) red snapper (*Lutjanus campechanus*) silk snapper (*Lutjanus vivanus*) vermilion snapper (*Rhomboplites aurorubens*) yellowtail snapper (*Ocyurus chrysurus*) wenchman (*Pristipomoides aquilonaris*) black grouper (*Mycteroperca bonaci*) gag (*Mycteroperca microlepis*) goliath grouper (*Epinephelus itajara*) Nassau grouper (*Epinephelus striatus*) red grouper (*Epinephelus morio*) scamp (*Mycteroperca phenax*) speckled hind (*Epinephelus drummondhayi*) snowy grouper (*Epinephelus niveatus*) warsaw grouper (*Epinephelus nigritus*) yellowedge grouper (*Epinephelus flavolimbatus*) yellowfin grouper (*Mycteroperca venenosa*) yellowmouth grouper (*Mycteroperca interstitialis*) greater amberjack (*Seriola dumerili*) lesser amberjack (*Seriola fasciata*) almaco jack (*Seriola rivoliana*) banded rudderfish (*Seriola zonata*) gray triggerfish (*Balistes capriscus*) blueline tilefish (*Caulolatilus microps*) goldface tilefish (*Caulolatilus chrysops*) tilefish (*Lopholatilus chamaeleonticeps*) hogfish (*Lachnolaimus maximus*) **Coastal Migratory Pelagic Fishes** cobia (*Rachycentron canadum*) king mackerel (*Scomberomorus cavalla*) Spanish mackerel (*Scomberomorus maculatus*)	**Corals** Class Hydrozoa (stinging and hydrocorals) Class Anthozoa (sea fans, whips, precious coral, sea pen, stony corals) Listed corals also covered under ESA consultation **Shrimp Fishery** brown shrimp (*Farfantepenaeus aztecus*) pink shrimp (*Farfantepenaeus duorarum*) royal red shrimp (*Pleoticus robustus*) white shrimp (*Litopenaeus setiferus*) **Spiny Lobster Fishery** spiny lobsters (*Panulirus argus*) **Highly Migratory Species** albacore (*Thunnus alalunga*) Atlantic bluefin tuna (*Thunnus thynnus*) Atlantic bigeye tuna (*Thunnus obesus*) Atlantic yellowfin tuna (*Thunnus albacares*) skipjack (*Katsuwonus pelamis*) swordfish (*Xiphias gladius*) blue marlin (*Makaira nigricans*) sailfish (*Istiophorus platypterus*) white marlin (*Tetrapturus albidus*) longbill spearfish (*Tetrapturus pfluegeri*) basking shark (*Cetorhinus maximus*) great hammerhead (*Sphyrna mokarran*) scalloped hammerhead (*Sphyrna lewini*) smooth hammerhead (*Sphyrna zygaena*) white shark (*Carcharodon carcharias*) nurse chark (*Ginglymostoma cirratum*) bignose shark (*Carcharhinus altimus*) blacktip shark (*Carcharhinus limbatus*) bull shark (*Carcharhinus leucas*) Caribbean reef shark (*Carcharhinus perezi*) dusky shark (*Carcharhinus obscurus*) Galapagos shark (*Carcharhinus galapagensis*) lemon shark (*Negaprion brevirostris*) narrowtooth shark (*Carcharhinus brachyurus*) night shark (*Carcharhinus signatus*) sandbar shark (*Carcharhinus plumbeus*) silky shark (*Carcharhinus falciformis*)

Table 1. Managed Species in the Gulf of Mexico.

Highly Migratory Species (continued)	**Highly Migratory Species (continued)**
spinner shark (*Carcharhinus brevipinna*)	smalltail shark (*Carcharhinus porosus*)
tiger shark (*Galeocerdo cuvieri*)	bigeye sixgill shark (*Hexanchus vitulus*)
bigeye sand shark (*Odontaspis noronhai*)	sevengill shark (*Heptranchias perlo*)
sand tiger shark (*Odontaspis taurus*)	sixgill shark (*Heptranchias griseus*)
whale shark (*Rhinocodon typus*)	longfin mako shark (*Isurus paucus*)
Atlantic angel shark (*Squatina dumerili*)	shortfin mako shark (*Isurus oxyrinchus*)
bonnethead shark (*Sphyrna tiburo*)	blue shark (*Prionace glauca*)
Atlantic sharpnose (*Rhinocodon terraenovae*)	oceanic whitetip shark (*Carcharhinus longimanu*)
blacknose shark (*Carcharhinus acronotus*)	bigeye thresher shark (*Alopias superciliosus*)
Caribbean sharpnose shark (*Rhinocodon porosus*)	common thresher shark (*Alopias vulpinus*)
finetooth shark (*Carcharhinus isodon*)	

ESA = Endangered Species Act.

Sources: GMFMC, 2004.
USDOC, NMFS, 2010.

Table 2. Described Essential Fish Habitat Locations for Reef Fish in the Gulf of Mexico.

Species Name	Eggs	Larvae	Post Larvae	Juveniles	Adults
Grey trigger	Sand bottoms near reef habitats in the spring and summer seasons		Upper water column in spring and summer seasons	Upper water column associated with *Sargassum* and eat from *Sargassum*	Continental shelf waters (>10 m; 33 ft), reefs in the late spring and summer, and eat invertebrates
Greater amberjack	Gulfwide	Gulfwide	Offshore in the summer	Gulfwide with floating structures (*Sargassum*) in the late summer and fall and feed on invertebrates	Gulfwide, near the structured habitat, eat invertebrates and fishes, and spawn in the spring and summer offshore
Lesser amberjack	Gulfwide	Gulfwide		Gulfwide, associated with floating structures (*Sargassum*) in the late summer and fall and feed on invertebrates	Gulfwide, near the bottom, associated with structures, feed on squid, and spawn in spring and fall
Almaco jack	Gulfwide	Gulfwide		Gulfwide, associated with floating structures (*Sargassum*) and barrier islands in the late summer and fall, and feed on invertebrates	Southern GOM, offshore associated with platforms, prey on fishes, and spawning is hypothesized to be spring and fall
Banded rudderfish		Gulf Stream every other month (starting with January)		Offshore, associated with floating structures (*Sargassum*), year round	Coastal waters over the continental shelf, both pelagic and epibenthic; feed on fish and shrimp, and spawn year round offshore
Hogfish				Seagrass beds of Florida Bay and eat invertebrates	Coral reefs and rocky flats, and eat mollusks
Queen snapper	Offshore	Offshore			Deep water in southern GOM (>100 m; 328 ft) in rocky bottoms; eat fish, crustaceans, and squid; and spawn in March and August in St. Lucia
Mutton snapper	Shallow continental shelf waters	Shallow continental shelf waters		Seagrasses during the summer	Seagrass or reefs, year round, eat nekton, and spawn in south Florida at drop offs near coral reefs in late spring

Table 2. Described Essential Fish Habitat Locations for Reef Fish in the Gulf of Mexico (continued).

Species Name	Eggs	Larvae	Post Larvae	Juveniles	Adults
Blackfin snapper	Continental shelf year round			Shallow waters with hard substrate (12-40 m; 39-131 ft) by the Virgin Islands in spring	Continental shelf edge, eat nekton, and spawn year round
Red snapper	Offshore in the summer and fall	Continental shelf waters in summer and fall, and eat rotifers and algae		Continental shelf associated with structures and feed on zooplankton and shrimp	Hard and irregular bottoms, eat nekton, and spawn offshore away from coral reefs in sand bottoms with low relief in summer and fall
Cubera snapper	Near coral reefs and wrecks of medium depth (80 m; 262 ft) in the summer			Shallow vegetated waters in estuaries near streams and rivers wide salinity ranges	Southern GOM near reefs and mangroves, in wide salinity ranges, eat nekton, and spawn in the Florida Keys at approximately 80 m (262 ft)
Gray snapper	High salinity continental shelf waters near coral reefs in the summer	High salinity continental shelf waters near coral reefs in the summer and eat zooplankton	Move to estuaries with vegetation (seagrass), wide salinity and temperature ranges, and eat copepods and amphipods	Feed on crustaceans	Onshore and offshore, eat nekton, and spawn offshore near reefs in summer
Lane snapper	Continental shelf and offshore in the summer			Low salinity inshore grasses, coral reefs, and soft bottoms (0-20 m; 0-65 ft), and eat small invertebrates	High salinity offshore waters in sand bottoms with structure; wide depth range of 4-130 m (13-426 ft); eat nekton, annelids, and algae; spawning peak offshore in midsummer
Silk snapper	Shallow water year round and eat nekton	Shallow water year round and eat nekton		Shallow water year round and eat nekton	Edge of the continental shelf (90-140 m; 295-459 ft), ascend at night, feed on nekton, and spawn year round (more so in the late summer)

Table 2. Described Essential Fish Habitat Locations for Reef Fish in the Gulf of Mexico (continued).

Species Name	Eggs	Larvae	Post Larvae	Juveniles	Adults
Yellowtail snapper	Found in February and October	Shallow water with vegetation and structure and feed on zooplankton		Nearshore with vegetation and move to shallow coral reefs with age	Semipelagic and use deeper coral reefs (50 m; 164 ft), feed on nekton, and spawn away from shore with peaks in February-April and September-October
Vermilion snapper				Coral reefs and rocky bottoms (20-200 m; 65-656 ft), spawn offshore in spring-summer	Coral reefs and rocky bottoms (20-200 m; 65-656 ft), and spawn offshore in spring-summer
Wenchman	Continental shelf waters, warmer months	Continental shelf waters, warmer months			Hard bottoms of the mid- to outer shelf (80-200 m; 262-656 ft), feed on small fish, and spawn in burrows and cervices in summer and fall
Blueline and goldface tilefishes	Pelagic and occur offshore	Pelagic and occur offshore		Pelagic and occur offshore	Continental shelf edge and upper slope (91-150 m; 298-492 ft) associated with irregular bottoms, feed on benthic invertebrates and some fish, and spawn in burrows and crevices in summer and fall
Tilefish	Pelagic and occur on the near shelf edge in the spring and summer	Pelagic and occur on the near shelf edge in the spring and summer			Outer continental shelf (>250 m; 820 ft), feed on crustaceans, burrow in clay, and spawn spring to fall
Speckled hind	Pelagic and occur offshore	Pelagic and occur offshore		Shallow waters	Hard bottoms/ rocky reefs commonly at 60-120 m (196-393 ft); they are the apex predator of the mid-shelf coral reef and spawn at continental shelf edge in spring and late summer

Table 2. Described Essential Fish Habitat Locations for Reef Fish in the Gulf of Mexico (continued).

Species Name	Eggs	Larvae	Post Larvae	Juveniles	Adults
Yellowedge grouper	Pelagic and occur offshore	Pelagic and occur offshore		Shallow waters with rocky bottom habitats	Outer continental shelf (>180 m; 590 ft) with high relief, hard-bottom habitats; feed on nekton; and spawn in the spring and summer
Goliath grouper (protected)	Pelagic and occur offshore in the late summer and early fall	Pelagic and occur offshore in the late summer and early fall		High salinity (>25 psu) estuaries and bays, and feed on crustaceans and vegetation	Near jetties, coral reefs, and crevices at 2-55 m (6-180 ft); feed on crustaceans; and spawn from summer to winter with peaks in the late summer offshore in structures or patchy reefs
Red grouper	Pelagic and occur offshore over the continental shelf, and feed on zooplankton	Pelagic and occur offshore over the continental shelf, and feed on zooplankton		Inshore by seagrass and rock formation, have wide salinity range, feed on crustaceans, and move into deeper waters with size	Continental shelf near live bottoms and crevices (3-190 m; 9-623 ft), feed on nekton, and spawn offshore as protogynous hermaphrodites in late the winter and spring
Marbled grouper (insufficient information to identify EFH)					
Snowy grouper	Pelagic and occur offshore	Pelagic and occur offshore		Benthic and found inshore associated with shallow reefs, feed on nekton, and move offshore with size	Deep water (100-200 m; 328-656 ft) with high-relief rocky bottoms, feed on nekton, and spawn in spring and summer
Nassau grouper (protected)	Not offshore but are in highly saline waters in the winter	Not offshore but are in highly saline waters in the winter, and start feeding on other larvae		Saline, shallow, vegetated waters or associated with reefs in similar waters, move offshore with size, and start feeding on fishes	Associated with reeds and crevices, feed on nekton, and spawn in the winter at full moon over soft corals, sponges, and sand

Table 2. Described Essential Fish Habitat Locations for Reef Fish in the Gulf of Mexico (continued).

Species Name	Eggs	Larvae	Post Larvae	Juveniles	Adults
Black grouper	Pelagic and occur offshore	Pelagic and occur offshore		Inshore to estuaries with seagrass, rocky bottoms, or coral reefs, eat crustaceans, and move to deeper water with size	Deeper (>20 m; 65 ft) waters than the other life history stages over rocky bottoms and coral reefs (mid to high relief), feed on fish, and spawn in May near the Florida Keys
Yellowmouth grouper	Pelagic and occur offshore	Pelagic and occur offshore		Shallow waters with mangroves (e.g., lagoons) and feed on fishes	Inshore in water depths <100 m (328 ft) over rocky bottom and corals, feed on nekton, and spawn in spring and summer
Gag	Pelagic and occur in the winter to spring	Pelagic and occur in the winter to spring, shallow (<5 m; 16 ft) estuaries associated with grass beds or oysters, eat crustaceans then nekton, and then recruit to offshore hard bottoms in the fall			In water depths of 20-100 m (65-326 ft) associated with hard bottoms that have some relief, feed on nekton, and spawn offshore shelf edge break in the winter but peaking in the spring
Scamp	Pelagic and occur offshore in the spring	Pelagic and occur offshore in the spring		Inshore associated with hard bottoms	Continental shelf associated with high-relief hard bottoms that have complex structure, feed on nekton, and spawn at the continental shelf edge (60-100 m; 196-328 ft) in complex habitat from early spring to summer

Table 2. Described Essential Fish Habitat Locations for Reef Fish in the Gulf of Mexico (continued).

Species Name	Eggs	Larvae	Post Larvae	Juveniles	Adults
Yellowfin grouper				Seagrass beds then move to rocky bottoms	Adults are not common but can be found near the shoreline to mid-shelf with rocky bottoms and coral reefs, feed on nekton, and spawn in spring and summer

Table 3. Described Essential Fish Habitat Locations for Coastal Migratory Species Utilizing the Gulf of Mexico.

Species	Eggs	Larvae	Juveniles	Adults
King mackerel	Pelagic and occur offshore in spring and summer	Mid to outer continental shelf (25-180 m; 82-590 ft) in October and feed on other larval fishes	Inshore waters on the inner shelf and feed on estuarine dependent fish	Pelagic and occur in coastal to offshore waters, feed on nekton, and spawn from May to October on the outer continental shelf
Spanish mackerel	Pelagic and found on the continental inner shelf (<50 m; 164 ft) in spring and summer	Continental inner shelf from spring to fall and feed on larval fishes	Estuarine and coastal waters with a wide salinity range and feed on fishes	Inshore and coastal waters, feed on estuarine dependent fishes, and spawn on the inner shelf from May to September
Cobia	Top meter of the water column	Offshore waters	Coastal waters and offshore on the shelf in the upper water column, found in the summer, and feed on nekton	Shallow coastal waters and offshore shelf waters (1-70 m; 3-229 ft) from March to October and spawn in the shelf waters in the spring and summer

Table 4. Described Essential Fish Habitat and Spawning Locations for Shrimp in the Gulf of Mexico.

Species	Eggs	Larvae	Post Larvae	Juveniles	Adult
Brown shrimp			Migrate to estuaries in early spring	Associated with vegetation and mud bottoms, and sub-adults utilize bays and shelf as they move from estuaries to offshore waters	Spawn in deep waters (>18 m; 59 ft) over the continental shelf generally in the spring
White shrimp	Spring and fall			Associated with soft bottoms with detritus and vegetation	Nearshore soft bottoms and spawn at <27 m (88 ft) from spring to fall, and migrate through the water column between night and day
Pink shrimp	Spring and summer			Utilize the seagrass beds (*Halodule* and *Thalassia*, depending on size)	Offshore over the continental shelf on sand/shell bottoms
Royal red shrimp	Winter and spring on the upper slope (250-550 m; 820-1,804 ft)				Upper slope associated with muddy bottoms and spawn there from winter to spring, feed on benthic organisms, and are not estuarine dependent

Table 5. Described Essential Fish Habitat Locations for Highly Migratory Species in the Gulf of Mexico.

Species	Eggs	Larvae	Juvenile	Adult
Atlantic bluefin tuna	100 m (328 ft) to the EEZ	100 m (328 ft) to the EEZ		Spawn in the spring over the continental shelf in the Gulf
Atlantic bigeye tuna			Found in waters adjacent to Louisiana/Mississippi and Florida*	Central Gulf**
Atlantic yellowfin tuna	Offshore	Offshore	Central Gulf from Texas to the Florida panhandle	Offshore
Albacore tuna				Central Gulf
Skipjack tuna	Offshore out to the EEZ	Offshore out to the EEZ	Central Gulf waters from Louisiana to Florida	Central Gulf waters from Texas to Florida and spawn offshore
Swordfish	100 fathoms (200 m; 656 ft) to the EEZ	100 fathoms (200 m; 656 ft) to the EEZ	Gulf waters from Texas to Florida	Spawn offshore associated with the Loop Current
Blue marlin	Mid-Florida Keys	Mid-Florida Keys	Central Gulf waters from Texas to Florida	Central Gulf waters from Texas to Florida
White marlin			Central Gulf from Texas to the Florida panhandle and Keys	Central Gulf from Texas to the Florida panhandle and Keys
Sailfish			Central Gulf waters from Texas, Louisiana, and the Florida panhandle	Central Gulf waters from Texas, Louisiana, and the Florida panhandle
Longbill spearfish			Central Gulf from Louisiana to the Florida panhandle and the Keys	Central Gulf from Louisiana to the Florida panhandle and the Keys

EEZ = Exclusive Economic Zone; GOM = Gulf of Mexico.

* The states are used to help visualize approximately where in the GOM the species could occur.

** Central Gulf—This is the central portion of the entire GOM, not the GOM's Central Planning Area (CPA).

Table 6. Described Essential Fish Habitat Locations for Shark Species Utilizing the Gulf of Mexico.

Shark Species	Neonates	Young of Year	Juveniles	Adult
Basking shark (no EFH described for the GOM)				
Great hammerheads				Coastal areas from Texas to Florida*
Scalloped hammerhead	Coastal waters from Texas to Florida	Coastal waters from Texas to Florida	Coastal and offshore waters from mid-Texas to Louisiana	Coastal GOM waters from Texas to Florida and offshore waters from Texas to eastern Louisiana
Smooth hammerhead (no EFH identified due to insufficient data)				
White sharks				Southwest coastal waters of Florida and Florida Keys
Nurse sharks				Coastal waters of Florida
Bignose shark			Localized areas from Louisiana to the Florida Keys	Localized areas from Louisiana to the Florida Keys
Blacktip sharks				Coastal waters from Texas to the Florida Keys
Bull shark	Coastal waters of Texas but are also found in localized areas in Florida	Coastal waters of Texas, but are also found in localized areas in Florida	Coastal waters from Texas through eastern Louisiana to the panhandle and western Florida	Southern and mid-coast of Texas to Louisiana and the Florida Keys
Caribbean reef sharks				Coastal waters of the Florida Keys
Dusky shark			Central Gulf** adjacent to south Texas and Florida	Central Gulf adjacent to south Texas and Florida
Galapagos shark (no EFH identified due to insufficient data)				

Table 6. Described Essential Fish Habitat Locations for Shark Species (continued).

Shark Species	Neonates	Young of Year	Juveniles	Adult
Lemon shark	Found in waters adjacent to mid-Texas and the Florida Keys with a localized area adjacent to the middle of Florida	Found in waters adjacent to mid-Texas and the Florida Keys with a localized area adjacent to the middle of Florida	Found in coastal waters of Texas, eastern Louisiana, and Florida	Coastal waters adjacent to Florida
Narrowtooth shark (no EFH identified due to insufficient data)				
Night sharks				Found in localized areas of offshore waters adjacent to Texas, Louisiana, and Florida
Sandbar shark				Coastal waters near Florida and some localized areas near Alabama
Silky sharks				Offshore waters in the Central Gulf adjacent to Texas, Louisiana, and the Florida Keys
Spinner shark	Coastal waters near Texas, Louisiana, and Florida	Coastal waters near Texas, Louisiana, and Florida	Localized in waters reaching from south Texas to Florida	Localized in waters reaching from south Texas to Florida
Tiger sharks	Localized areas near the Texas/Louisiana border and Florida panhandle	Localized areas near the Texas/Louisiana border and Florida panhandle	Found in Florida waters	Found in both shallow and deep waters
Bigeye sand shark (no EFH identified due to insufficient data)				
Sand shark (no EFH described in the GOM)				
Whale sharks				Found in the waters of the Central Gulf ranging from Texas to the Florida panhandle

Table 6. Described Essential Fish Habitat Locations for Shark Species (continued).

Shark Species	Neonates	Young of Year	Juveniles	Adult
Atlantic angel shark			Localized in coastal waters from eastern Louisiana to the Florida panhandle	Localized in coastal waters from eastern Louisiana to the Florida panhandle
Caribbean sharpnose shark (no EFH identified due to insufficient data)				
Bonnethead shark				Found in coastal shallow waters with sandy and muddy bottoms around Texas, eastern Mississippi, and to the Florida Keys
Atlantic sharpnose shark				Found in coastal waters from Texas to the Florida Keys
Blacknose shark	Found in the coastal waters of Florida	Found in the coastal waters of Florida	Localized in the coastal waters of Texas, western Louisiana, and Mississippi to Florida	Localized areas in waters from Texas to the Florida Keys
Finetooth shark	Inshore waters from Texas, eastern Louisiana, Mississippi, Alabama, and the Florida panhandle	Inshore waters from Texas, eastern Louisiana, Mississippi, Alabama, and the Florida panhandle	Found in inshore waters from south Texas and the Florida Keys, and from eastern Louisiana to the Florida panhandle	Found in inshore waters from south Texas and the Florida Keys, and from eastern Louisiana to the Florida panhandle
Oceanic whitetip shark				Found in the Central Gulf and the Florida Keys
Common thresher shark				Found in the Central Gulf and the Florida Keys
Bigeye thresher shark				Found in the Central Gulf and Key West, Florida
Longfin makos and shortfin makos				Deepwater offshore in the Central Gulf and the Florida Keys

Table 6. Described Essential Fish Habitat Locations for Shark Species (continued).

Shark Species	Neonates	Young of Year	Juveniles	Adult
Porbeagle shark (no EFH described for the GOM)				
Blue shark (no EFH described for the GOM)				

EFH = Essential Fish Habitat; GOM = Gulf of Mexico.

* The states are used to help visualize approximately where in the GOM the species could occur.

** Central Gulf—This is the central portion of the entire GOM, not the GOM's Central Planning Area (CPA).

The Department of the Interior Mission

The Department of the Interior protects and manages the Nation's natural resources and cultural heritage; provides scientific and other information about those resources; and honors the Nation's trust responsibilities or special commitments to American Indians, Alaska Natives, and affiliated island communities.

The Bureau of Ocean Energy Management Mission

The Bureau of Ocean Energy Management (BOEM) is responsible for managing development of U.S. Outer Continental Shelf energy and mineral resources in an environmentally and economically responsible way.