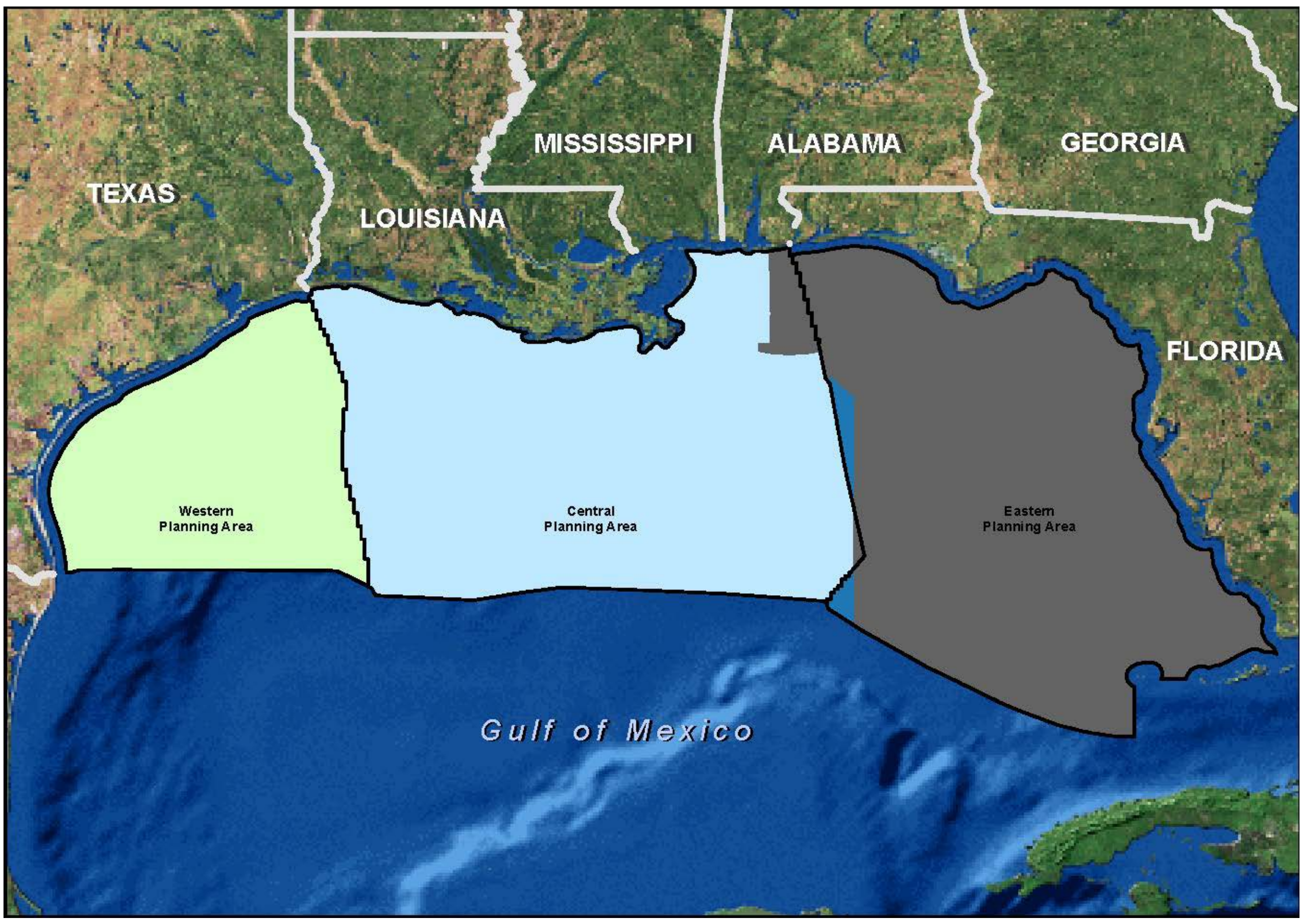
OCS EIS/EA
BOEM 2024-032

Gulf of Mexico Regional OCS Oil and Gas Lease Sales

Draft Programmatic Environmental Impact Statement



U.S. Department of the Interior
Bureau of Ocean Energy Management
Gulf of Mexico Regional Office

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REGIONAL DIRECTOR'S NOTE

This Draft Programmatic Environmental Impact Statement (EIS) analyzes a Federal action, i.e., a proposed Gulf of Mexico (GOM) Outer Continental Shelf (OCS) oil and gas lease sale. This document is expected to be used to inform the decision for the first GOM oil and gas lease sale proposed in the 2024-2029 National OCS Oil and Gas Program, to be used and supplemented as appropriate for decisions on future proposed Gulf of Mexico OCS oil and gas lease sales, to be used for tiering purposes for associated site- and activity-specific OCS oil- and gas-related activity approvals, and/or to help inform extraordinary circumstance reviews to ensure that categorical exclusions are used appropriately.

This Draft Programmatic EIS analyzes the potential impacts of a proposed action on the marine, coastal, and human environments. It is important to note that this Draft Programmatic EIS was prepared using the best information that was publicly available at the time this document was prepared. This Programmatic EIS's analysis focuses on identifying the baseline conditions and potential environmental effects of oil and natural gas leasing, exploration, development, and production in the GOM. This Programmatic EIS will also assist decisionmakers in making informed, future decisions regarding the approval of operations, as well as leasing.

BOEM's Gulf of Mexico Regional Office and its predecessors have been conducting environmental analyses of the effects of OCS oil and gas development since the inception of the National Environmental Policy Act of 1969. We have prepared and published more than 75 draft and final EISs. Our goal has always been to provide factual, reliable, and clear analytical statements in order to inform decisionmakers and the public about the environmental effects of proposed OCS oil- and gas-related activities and their alternatives. We view the EIS process as providing a balanced forum for early identification, avoidance, and resolution of potential conflicts. It is in this spirit that we welcome comments on this document from all concerned parties.

James Kendall
Regional Director
Bureau of Ocean Energy Management
Gulf of Mexico Regional Office

COVER SHEET

Draft Programmatic Environmental Impact Statement
for
Gulf of Mexico Regional OCS Oil and Gas Lease Sales

	Draft (x)	**Final ( )**
Type of Action:	Administrative (x)	Legislative ( )

Area of Potential Impact: Offshore Marine Environment and Coastal Counties/Parishes of Texas, Louisiana, Mississippi, Alabama, and northwestern Florida

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ABSTRACT

This Draft Programmatic Environmental Impact Statement (EIS) analyzes a proposed Federal action, i.e., a Gulf of Mexico (GOM) Outer Continental Shelf (OCS) oil and gas lease sale. This document is expected to be used to inform the decision for the first Gulf of Mexico OCS oil and gas lease sale proposed in the 2024-2029 National OCS Oil and Gas Program, to be used and supplemented as appropriate for decisions on future proposed Gulf of Mexico OCS oil and gas lease sales, to be used for tiering purposes for associated site- and activity-specific OCS oil- and gas-related activity approvals, and/or to help inform extraordinary circumstance reviews to ensure categorical exclusions are used appropriately.

This Draft Programmatic EIS provides the following information in accordance with the National Environmental Policy Act (NEPA) and its implementing regulations, and it will be used to inform the decision whether to hold OCS oil and gas lease sales proposed in the National OCS Oil and Gas Program. The analysis will also inform decisions for site- and activity-specific OCS oil- and gas-related activities by being tiered to from site- and activity-specific NEPA documents (typically environmental assessments for plan approvals) or to help inform extraordinary circumstance reviews to ensure that categorical exclusions are used appropriately. This document includes the purpose of and need for the proposed action, identification of the alternatives, description of the affected environment, and an analysis of the potential environmental impacts of the proposed action, alternatives, and associated activities, including proposed mitigating measures and their potential

effects. Potential contributions to cumulative impacts resulting from activities associated with the proposed action are also analyzed.

Hypothetical scenarios were developed on the levels of activities, accidental events that are foreseeable (such as oil spills), and potential impacts that might result if the proposed action, or an alternative to the proposed action, is adopted. Activities and disturbances associated with the proposed action and alternatives on biological, physical, and socioeconomic resources are considered in the analyses.

This Draft Programmatic EIS analyzes the potential impacts of the proposed action and alternatives on air and water quality, coastal communities and habitats, benthic communities and habitats, pelagic communities and habitats, fishes and invertebrates, birds, marine mammals, sea turtles, commercial fisheries, recreational fishing, recreational resources, land use and coastal infrastructure, social factors (including environmental justice), economic factors, and cultural, historical, and archaeological resources. It is important to note that this Draft Programmatic EIS was prepared using the best information that was publicly available at the time this document was prepared. Where relevant information on reasonably foreseeable significant adverse impacts is incomplete or unavailable, the need for the information was evaluated to determine if it was essential to a reasoned choice among the alternatives and, if so, was either acquired or in the event it was impossible or exorbitant to acquire the information, accepted scientific methodologies were applied in its place.

Copies of this Draft Programmatic EIS and the other referenced publications may be obtained from the Bureau of Ocean Energy Management, Gulf of Mexico Regional Office, Office of Communications (GM 335A), 1201 Elmwood Park Boulevard, New Orleans, Louisiana 70123-2394, by telephone at 504-736-2519 or 1-800-200-GULF, or on BOEM's website at http://www.boem.gov/nepaprocess/ or https://www.boem.gov/environment/environmental-assessment/gulf-mexico-regional-ocs-oil-and-gas-programmatic.

EXECUTIVE SUMMARY

The Bureau of Ocean Energy Management (BOEM) issued the *2024-2029 Outer Continental Shelf Oil and Gas Leasing: Proposed Final Program* (2024-2029 National OCS Oil and Gas Program) on September 29, 2023 (BOEM 2023c). The 2024-2029 National OCS Oil and Gas Program includes proposed Gulf of Mexico (GOM) oil and gas lease sales tentatively scheduled in 2025, 2027, and 2029. The GOM Program Area for the three oil and gas lease sales proposed in the 2024-2029 National OCS Oil and Gas Program is comprised of the Western, Central, and a small portion of the Eastern Planning Areas (WPA, CPA, and EPA, respectively) not subject to Presidential Withdrawal.

BOEM conducts region-specific environmental reviews by Program Areas (e.g., Gulf of Mexico) to support decisions on individual, proposed Outer Continental Shelf (OCS) oil and gas lease sales (lease sales) in those areas. The Secretary of the Interior (Secretary) retains the discretion at the lease sale stage to determine whether, when, and under what terms a lease sale should be held and the precise acreage to be offered. This *Gulf of Mexico Regional OCS Oil and Gas Lease Sales: Draft Programmatic Environmental Impact Statement* (GOM Oil and Gas Programmatic EIS) analyzes a proposed Federal action, i.e., a Gulf of Mexico OCS oil and gas lease sale, to help inform the Secretary's decisionmaking process.

Chapter 1 – Purpose and Need

The Proposed Action evaluated in this Programmatic EIS is to hold an oil and gas lease sale on the Federal OCS in the GOM. This Programmatic EIS will be used to inform the decision for the first proposed GOM oil and gas lease sale in the 2024-2029 National OCS Oil and Gas Program. BOEM may also rely on this Programmatic EIS and/or supplement it as appropriate for decisions on future proposed GOM oil and gas lease sales. BOEM may also tier from this Programmatic EIS in future reviews for associated site- and activity-specific OCS oil- and gas-related activity approvals, and/or to help inform extraordinary circumstance reviews to ensure that categorical exclusions are used appropriately.

The purpose of the Proposed Action (i.e., a proposed GOM oil and gas lease sale) is to facilitate the potential development of those areas of the OCS that may contain economically recoverable oil and gas. Following lease issuance, BOEM and BSEE can approve exploration, development, and production activities through plan and permit approvals (subject to additional environmental review and regulatory oversight). This purpose is consistent with BOEM's mandate to further the orderly development of OCS oil and gas resources under the Outer Continental Shelf Lands Act (43 U.S.C. §§ 1331 *et seq.*). Each individual proposed oil and gas lease sale would provide qualified bidders the opportunity to bid upon and lease available acreage in the Gulf of Mexico OCS in order to explore, develop, and produce oil and natural gas.

The Proposed Action is needed to address the ongoing domestic demand for oil and gas resources and, per current law, to facilitate the development of offshore wind as a source of renewable electricity. Oil and gas from the Gulf of Mexico OCS contributes to meeting domestic demand. Oil serves as the feedstock for liquid hydrocarbon products, including gasoline, aviation and diesel fuel, and various petrochemicals. Gas is used to heat homes, generate electricity, and as feedstock necessary for the production of numerous other goods. Additionally, under the Inflation Reduction Act of 2022 (Public Law 117-169, enacted August 16, 2022), Congress directed that the Secretary of the Interior must hold an offshore oil and gas lease sale(s) totaling a minimum aggregate of 60 million acres in the year prior to issuing any offshore wind energy leases.

Chapter 2 – Alternatives Including the Proposed Action

BOEM considered a reasonable range of alternatives during the Programmatic EIS development process. These alternatives were identified through coordination with Tribal Governments, other Federal and State agencies, and through public comments received during the public scoping period for the Programmatic EIS (**Appendix A**).

- **Alternative A – No Action:** The cancellation of a single OCS oil and gas lease sale.
- **Alternative B (The Proposed Action)** – **Regionwide OCS Lease Sale:** An OCS oil and gas lease sale to include all available unleased blocks in the GOM lease sale area, with the exceptions of whole and partial blocks within the boundaries of the Flower Garden Banks National Marine Sanctuary as of the July 2008 Memorandum on Withdrawal of Certain Areas of U.S. OCS from Leasing Disposition, whole and portions of blocks currently under Presidential withdrawal, and blocks that are adjacent to or beyond the United States' Exclusive Economic Zone (Extended Continental Shelf Area). This Alternative meets the aggregate acreage requirement of the Inflation Reduction Act to issue OCS wind energy leases.
- **Alternative C (The Preferred Alternative) – Inflation Reduction Act Targeted OCS Lease Sale Area:** An OCS oil and gas lease sale to include all available unleased blocks in the GOM lease sale area, with the exceptions under Alternative B as well as whole and partial blocks subject to the Topographic Features Stipulation; Live Bottom (Pinnacle Trend) Stipulation; Blocks South of Baldwin County, Alabama, Stipulation; whole and partial blocks that contain Significant Sediment Resource Areas (SSRA); Wind Energy Area Options (Areas A, B, C, D, E, F, G, and H) as of April 2024, final Wind Energy Areas (Areas I, J, K, L, and N), and Wind Energy Lease(s) (i.e., OCS-G 37334); whole and partial blocks within the Rice's whale core distribution area; and whole and partial blocks within the Rice's whale proposed critical habitat area. This Alternative meets the aggregate acreage requirement of the Inflation Reduction Act to issue OCS wind energy leases. Alternative C is the agency's Preferred Alternative because it offers more than 60 million acres for leasing to satisfy the Inflation Reduction Act requirements for holding offshore wind energy sales, reduces potential marina spatial planning conflicts, and avoids areas with the most vulnerable environmental resources.

- **Alternative D – Inflation Reduction Act Targeted OCS Lease Sale Area with Additional Exclusions:** An OCS oil and gas lease sale to include all available unleased blocks in the GOM lease sale area, with the exception of blocks that were excluded from consideration under Alternatives B and C, as well as whole and partial blocks in the EPA; additional whole and partial blocks of the Gulf of Mexico Wind Leasing Call Area; whole and partial blocks in coastal OCS waters shoreward of the 20-m (66-ft) isobath to avoid additional impacts to coastal stocks of bottlenose dolphin (*Tursiops truncatus*); whole and partial blocks around the expanded Flower Garden Banks National Marine Sanctuary as of March 22, 2021; and whole and partial blocks identified by the Department of Defense as mission incompatibility areas. This Alternative does not meet the aggregate acreage requirement of the Inflation Reduction Act to issue OCS wind energy leases.

BOEM considers the use of mitigation at all phases of energy development and planning. Mitigations can be applied at the prelease stage, typically through applying lease stipulations, or at the post-lease stage by applying site-specific mitigating measures to plans, permits, and/or authorizations (refer to **Appendix F** of this Programmatic EIS and Chapter 5 of the *Description of the Potential Effects from Gulf of Mexico OCS Oil- and Gas-Related Activities: A Supporting Information Document* [GOM Oil and Gas SID]). The lease stipulations being considered in this analysis are the Military Areas; Evacuation; Coordination; Protected Species; Topographic Features; United Nations Convention on the Law of the Sea Royalty Payment; Agreement between the United States of America and the United Mexican States Concerning Transboundary Hydrocarbon Reservoirs in the Gulf of Mexico (Transboundary Stipulation); Live Bottom (Pinnacle Trend); Blocks South of Baldwin County, Alabama; Restrictions due to Rights-of-Use and Easements for Floating Production Facilities; and the Royalties on All Produced Gas Stipulation. These stipulations will be considered for adoption in the Record of Decision by the decisionmaker, as applicable, under authority delegated by the Secretary of the Interior. The Topographic Features and Live Bottom (Pinnacle Trend) Stipulations have been applied as programmatic mitigation in the 2024-2029 National OCS Oil and Gas Program EIS (BOEM 2023b) and Record of Decision (BOEM 2023f) and, therefore, would apply to all leases issued for GOM oil and gas lease sales under the 2024-2029 National OCS Oil and Gas Program in designated lease blocks.

Following an oil and gas lease sale, a lessee seeks approvals to develop their lease by preparing and submitting OCS plans. These OCS plans are reviewed by BOEM and the Bureau of Safety and Environmental Enforcement and, depending on what is proposed to take place on a specific lease, plans may be denied, approved, or approved with conditions of approval (COA). The COAs become part of the approved post-lease authorization and include environmental protections, requirements that maintain conformance with law, the requirements of other agencies having jurisdiction, or safety precautions.

Chapter 3 – Activities, Scenarios, and Impact-Producing Factors

This chapter describes the potentially occurring actions associated with a single representative oil and gas lease sale and the cumulative activities that provide a framework for a detailed analysis of the potential environmental impacts. Exploration and development scenarios describe impact-producing factors (e.g., infrastructure and activities) that could potentially affect the biological, physical, and socioeconomic resources in the GOM. They also include a set of ranges for resource estimates, projected exploration and development activities, and impact-producing factors. **Table ES-1** includes the impact-producing factor categories analyzed for routine OCS oil- and gas-related activities, OCS oil and gas accidental events, and cumulative activities.

Table ES-1. Impact-Producing Factors Related to Routine Activities, Accidental Events, or Cumulative Activities.

Routine Activities	Accidental Events	Cumulative Activities
Air Emissions and Pollution	Unintended Releases into the Environment	Air Emissions and Pollution
Discharges and Wastes	Response Activities	Discharges and Wastes
Bottom Disturbance	Strikes and Collisions	Bottom Disturbance
Noise	-	Noise
Coastal Land Use/Modification	-	Coastal Land Use/Modification
Lighting and Visual Impacts	-	Lighting and Visual Impacts
Offshore Habitat Modification/ Space Use	-	Offshore Habitat Modification/ Space Use
Socioeconomic Changes and Drivers	-	Socioeconomic Changes and Drivers
-	-	Climate Change
-	-	Natural Processes
-	-	Other Cumulative Activities

Offshore activities are described in the context of scenarios for an OCS oil and gas lease sale (**Chapter 3.1**) and for the OCS Oil and Gas Program (**Chapter 3.6**). BOEM's Gulf of Mexico Regional Office developed these scenarios to provide a framework for detailed analyses of potential impacts of an oil and lease sale. The scenarios are presented as ranges (low to high) of the amounts of undiscovered, unleased hydrocarbon resources estimated to be leased and produced as a result of a proposed action. The scenarios encompass a range of routine activities (e.g., the installation of platforms, drilling wells, and pipelines; and the number of helicopter operations and service-vessel trips) that would be needed to develop and produce the amount of forecasted oil and gas resources, as well as reasonably foreseeable accidental events (e.g., oil spills). Refer to the *Gulf of Mexico Catastrophic Spill Event Analysis: High-Volume, Extended-Duration Oil Spill Resulting from Loss of Well Control on the Gulf of Mexico Outer Continental Shelf; 2nd Revision* (GOM Catastrophic Spill Event Analysis) technical report (BOEM 2021c) for an assessment of potential impacts resulting from a low-probability catastrophic spill in the GOM similar in nature to the *Deepwater Horizon* explosion, oil spill, and subsequent response, which is not part of a proposed action. This analysis is separate from the Oil Spill Risk Analysis (OSRA) model used for a single oil and gas lease sale and the Cumulative OCS Oil and Gas Program evaluated in this Programmatic EIS.

Chapter 4 – Affected Environment and Environmental Consequences

This chapter summarizes the affected environment, introduces issues of programmatic concern (i.e., life cycle greenhouse gas (GHG) emissions and social cost of GHG, space-use conflicts, and decommissioning), and examines the potential impacts of a single representative OCS oil and gas lease sale under Alternatives A-D. Detailed affected environment and potential impact descriptions are included by resource in the GOM Oil and Gas SID (BOEM 2023e), which is hereby incorporated by reference. Analysis of the alternatives for each resource considers routine activities, accidental events, cumulative impact analysis, and incomplete or unavailable information. Summaries of the resources included in this analysis and their expected impact levels by alternative are included below. Impact-level conclusions were considered with and without the application of BOEM stipulations since the Secretary of the Interior has the discretion to choose which stipulations are applied for each oil and gas lease sale decision.

BOEM has included an updated life-cycle greenhouse gas (GHG) emissions and social cost of GHG emissions analysis based on a single representative GOM oil and gas lease sale (**Chapter 4.0.2.1** and **Appendix H**). Potential space-use conflicts may exist between OCS use for OCS oil and gas operations, using OCS sediment for coastal resiliency, the use of the Wind Energy Area (WEA) Options (Areas A, B, C, D, E, F, G, and H) as of April 2024, final Wind Energy Areas (Areas I, M, J, K, L, and N) for OCS wind energy development, Wind Energy Lease(s) (i.e., OCS-G 37334), and potential future use for carbon capture and sequestration projects (**Chapter 4.0.2.2**). BOEM has also included an expanded description of decommissioning activities (**Appendix J**). BOEM discusses these issues and their relationship to the proposed action in **Chapter 4.0.2**.

When both domestic and foreign lifecycle greenhouse gas emissions are considered, BOEM's analysis finds that total greenhouse gas emissions would increase under the proposed action. BOEM's combined quantitative and qualitative GHG analyses represent the best available and scientifically credible approach for comparison of GHG emissions from the proposed action and the No Action Alternative (Alternative A), and serve as a proxy for evaluating and comparing impacts to climate change under the proposed action and the No Action Alternative (Alternative A).

BOEM has identified potential space-use conflicts or competing interests between BOEM's Program Areas within the proposed OCS oil and gas lease sale areas considered under Alternatives B-D. However, in the event that incompatibilities would arise, BOEM could utilize lease stipulations to help mitigate the potential conflicts. Because some SSRAs may be in the blocks available for OCS oil and gas leasing under Alternative B, BOEM would use Information to Lessees and Notices to Lessees and Operators (NTLs) to inform lessees of the location of SSRAs and areas of active dredging if this alternative was selected. BOEM policy to reduce space-use conflicts in SSRAs could lead to post-lease conditions of approval that may include modification of operations and monitoring of pipeline locations after installation. Alternatives C and D exclude blocks containing SSRAs and would, therefore, have less space-use conflicts with GOM oil and gas development than Alternative B.

It could be difficult to place OCS oil and gas infrastructure and drill for oil and gas within the same areas as the renewable energy infrastructure due to the size of the wind field and seafloor cables under Alternative B. Under Alternatives C and D, GOM oil and gas leasing is excluded from the WEAs and GOM Wind Leasing Call Area, respectively. These exclusions would minimize the space-use conflicts between OCS wind energy and oil and gas development. However, conflicts with vessel traffic may still occur. The Bipartisan Infrastructure Law authorized BOEM to regulate carbon sequestration activities on the OCS; however, at this time, BOEM has not issued regulations for these activities. These projects are expected to be initially limited to areas of decreased oil and gas development interest (reduced oil and gas saline reservoirs or depleted oil and gas reservoirs occurring closer to shore). Space-use conflicts under Alternatives B and C between carbon sequestration and OCS oil- and gas-related activities could be mitigated and even further reduced under Alternative D by removing areas more suitable for carbon sequestration projects. Alternative A would limit adding more OCS oil- and gas-related infrastructure, therefore minimizing space-use conflicts that could occur with other OCS activities, including in the SSRA blocks, Wind Energy Options as of April 2024, final identified WEAs, Wind Energy Lease(s) (i.e., OCS-G 37334), and carbon sequestration-related activities.

OCSLA and its implementing regulations, as well as the terms and conditions of the offshore oil and gas leases, ROWs, and RUEs granted by Interior and other applicable laws and regulations, require lessees, operation right holders, and holders of ROWs and RUEs to, among other things: (i) permanently plug all wells; (ii) remove all platforms and other facilities; (iii) decommission all pipelines; and (iv) clear the seafloor of all obstructions created by the lease, pipeline ROW, and RUE operations within one year after termination or when BSEE determines they are of no future use (hereinafter, decommissioning activities). The Government Accountability Office (GAO) has recently reviewed BSEE's management of oil and gas pipelines (GAO 2021) and oversight of decommissioning deadlines (GAO 2024) and made several recommendations. The U.S. Department of the Interior has agreed with all recommendations made by these GAO reports, is currently working towards their implementation, and presents expanded descriptions of decommissioning activities in this Programmatic EIS (**Chapter 4.0.2.3** and **Appendix J**).

BOEM's subject-matter experts conducted a search and considered new information made available since publication of the GOM Oil and Gas SID. The subject-matter experts then took into consideration the potential impacts of the expected impact-producing factors from routine activities and accidental events, the expected levels of activity detailed in the exploration and development scenario, and any mitigations to arrive at impact conclusions (with and without applicable lease stipulations) for each resource category under each alternative. The subject-matter experts also evaluated the incremental impacts of a proposed action, and the cumulative impacts of a proposed action when added to all past, present, and reasonably foreseeable future OCS oil- and gas-related activities, as well as non-OCS oil- and gas-related activities (**Chapter 4.17**). The overall conclusions for certain environmental resources are not based on impacts to individuals, small groups of animals, or small areas of habitat, but rather on impacts to the resources/populations as a whole. All incomplete and unavailable information was disclosed and its relevance to a reasoned choice among alternatives was evaluated.

Air Quality

BOEM has analyzed the potential impacts to air quality with regards to the scenario and impact-producing factors (IPFs) provided in **Chapter 3**. The impact levels for Alternative A (i.e., cancellation of a single proposed oil and gas lease sale) are the combined impacts that would be expected from all ongoing activities associated with existing oil and gas leases, as well as non-OCS oil- and gas-related sources as summarized in **Chapter 3.6**. Impacts from routine activities and accidental events to air quality would generally be the same across all action alternatives, i.e., **negligible** to **moderate negative**, with the only potential exception being methane, which could lessen under Alternative C or D should leasing activity occur mostly in water depths greater than 200 m (656 ft) where less venting would be anticipated. Steps could also be taken to require shallow-water facilities to flare rather than vent; however, this could cause increased emissions of other air pollutants like CO_2. If projected methane emissions are less, this has potential effects to the GHG emissions analysis discussed in **Chapter 4.0.2.1**. In the context of past, present, and reasonably foreseeable activities within the area of analysis, the *incremental contribution* of a proposed GOM oil and gas lease sale to cumulative impacts on air quality would likely be **minor** but potentially up to **major negative** across all action alternatives for certain areas. When considering that the existing baseline conditions of the Houston-Galveston-Brazoria area are in nonattainment for ozone (O_3), cumulative impacts could be **moderate** to **major** if notable and measurable levels of O_3 caused by an OCS oil and gas lease sale were to reach the Houston-Galveston-Brazoria area, slowing down the long-term ability of the area to recover from chronic nonattainment status for O_3 (Li et al. 2023).

Water Quality

BOEM has analyzed the potential impacts to water quality with regards to each of the alternatives, the scenario, and IPFs. Under Alternative A, if a single OCS oil and gas lease sale were cancelled, any potential impacts to water quality from the proposed action would be **none**. Under Alternatives B, C, and D, an OCS oil and gas lease sale could result in **negligible** to **moderate adverse** impacts on water quality. Lessees are required to comply with regulations such as the Clean Water Act, which minimizes water quality impacts from routine OCS oil- and gas-related activities. As such, there are no additional water quality-specific mitigating measures being contemplated under any of the action alternatives. While Alternatives C and D would potentially change the spatial distribution of activities compared to Alternative B, they would not change the types of activities or their overall levels to a degree that would result in a meaningful difference in the overall impacts to water quality when compared to Alternative B. Therefore, the impact conclusions are the same as under Alternative B but with a lowered potential for impacts in those areas excluded from leasing.

Non-OCS oil- and gas-related activities also influence water quality in the GOM through discharges and wastes, bottom disturbance, coastal land use/modification, and air emissions and pollution (**Chapter 3.6**). When considered in the context of all other past, present, and reasonably foreseeable activities in the lease sale area, the *incremental contribution* of an OCS oil and gas lease sale in the geographic areas defined by Alternative B, C, or D to cumulative impacts on water quality would be **negligible**. The GOM Region is generally rated as fair (USEPA 2012). An OCS oil and gas lease sale would not be expected to result in a notable change to water quality, or have a notable or measurable contribution to, any new or ongoing significant cumulative impacts not already being experienced by water quality in the area of analysis. However, there is the potential for a large spill (e.g., ≥1,000 bbl), should one occur, to result in up to **moderate** cumulative impacts to water quality depending on the characteristics of the spill, baseline conditions at the time of the event, and weather and oceanographic conditions, among other variables.

Coastal Communities and Habitats

BOEM has analyzed the potential impacts to coastal communities and habitats with regards to each of the alternatives, scenario, and IPFs. Under Alternative A, if a single proposed OCS oil and gas lease sale were cancelled, potential impacts to coastal communities and habitats from an OCS oil and gas lease sale would be **none**. Under Alternatives B, C, and D, an OCS oil and gas lease sale could result in **negligible** to **moderate adverse** impacts on coastal communities and habitats. Under Alternative C, removal of whole and partial SSRA blocks and whole and partial blocks proposed to be subject to the Blocks South of Baldwin County, Alabama, Stipulation from leasing consideration may result in decreased potential impacts from spills and spill response in coastal habitats. Under Alternative D, removal of whole and partial blocks of coastal OCS waters shoreward of the 20-m (66-ft) isobath from leasing consideration may further decrease potential impacts from spills and spill response.

Baseline environmental impacts from natural and anthropogenic stressors, including sea-level rise, coastal development, and disturbance are known to affect coastal communities and habitats historically and presently. Coastal habitats and communities would continue to be exposed to these and other ongoing and planned cumulative activities over the timeframe considered in this Programmatic EIS (**Chapter 3.6**). When considered in the context of all other past, present, and reasonably foreseeable activities in the OCS lease sale area, the *incremental contribution* of an OCS oil and gas lease sale in the geographic areas defined by Alternative B, C, or D to cumulative impacts on coastal communities and habitats would be **negligible** to **minor adverse**. An OCS oil and gas lease sale would not be expected to result in, or have a notable or measurable contribution to, any new or ongoing significant cumulative impacts not already being experienced by coastal communities in the area of analysis. The most substantive long-term changes to GOM coastal habitats may include conversion of wetlands to other land uses, subsidence, and continuing sea level rise.

Benthic Communities and Habitats

BOEM has analyzed the potential impacts to benthic communities and habitats, including protected corals (i.e., ESA-listed corals and designated coral critical habitat), with regards to each of the alternatives, scenario, and IPFs. Under Alternative A, if a single OCS oil and gas lease sale were cancelled, any potential impacts to benthic communities and habitats, including protected corals, from an OCS oil and gas lease sale would be **none**. Under Alternative B, an OCS oil and gas lease sale could result in **negligible** to **major adverse** impacts on benthic communities and habitats, including protected corals. With the application of BOEM protective measures (i.e., avoidance, distancing, and shunting requirements), the impacts would be reduced to **negligible** to **minor adverse**. Benthic communities and habitats and protected corals located within the areas excluded from leasing under

Alternatives C and D are not expected to experience impacts from routine OCS oil- and gas-related activities because areas of impacts from routine OCS oil- and gas-related activities would occur within limited areas surrounding said activity, and not within the excluded areas. In addition, because ESA-listed corals and designated coral critical habitat are located within the excluded areas under Alternatives C and D, impacts from routine OCS oil- and gas-related activities would be **none** because these activities would not take place in the excluded areas. Routine impacts would be limited to the areas leased under each alternative. The impacts from accidental events to both benthic communities and habitats and protected corals would be the same for Alternatives C and D as described for Alternative B in **Chapter 4.4**. Under Alternatives C and D, an OCS oil and gas lease sale could result in **negligible** to **major adverse** impacts on benthic communities and habitats that are in areas not removed from leasing; however, with the application of BOEM protective measures (i.e., avoidance, distancing, and shunting requirements), the impacts would be reduced to **negligible** to **minor adverse**.

Baseline environmental impacts from natural and anthropogenic stressors, including artificial reef development, scuba diving, buoy placement (including renewable energy site assessment equipment), anchoring, fishing activity (trawling), past and existing OCS oil and gas activities, and State oil and gas activities, are known to affect benthic communities and habitats. The majority of non-OCS oil- and gas-related effects to benthic communities and habitats result from bottom-disturbing activities, primarily commercial bottom-tending fishing gear. Benthic habitats and communities are expected to continue experiencing cumulative impacts from these and other ongoing and planned activities over the timeframe considered in this Programmatic EIS (**Chapter 3.6**). When considered in the context of all other past, present, and reasonably foreseeable activities in the proposed OCS lease sale area, the *incremental contribution* of an OCS oil and gas lease sale in the geographic areas defined by Alternative B, C, or D to cumulative impacts on benthic communities and habitats, including protected corals, would be **negligible** when properly regulated and mitigated. An OCS oil and gas lease sale would not be expected to result in, or have a notable or measurable contribution to, any new or ongoing significant cumulative impacts not already being experienced by benthic communities and habitats in the area of analysis.

Pelagic Communities and Habitats

BOEM has analyzed the potential impacts to pelagic communities and habitats with regards to each of the alternatives, scenario, and IPFs. Under Alternative A, if a single proposed OCS oil and gas lease sale were cancelled, potential impacts to pelagic communities and habitats from an OCS oil and gas lease sale would be **none**. Under Alternatives B, C, and D, an OCS oil and gas lease sale could result in **negligible** to **minor adverse** impacts on pelagic communities and habitats, including *Sargassum*, when properly regulated as lessees are required to perform OCS oil- and gas-related activities in accordance with regulatory requirements.

Cumulative impacts to pelagic communities and habitats, including *Sargassum*, could result from air emissions and pollution, discharges and wastes, bottom disturbance, noise, lighting and visual impacts, offshore habitat modification/space use, unintended releases into the environment, response activities, and strikes and collisions associated with oil and gas activities from past and future sales, as well as from non-OCS oil and gas related activities. Programmatic issues like climate change and ocean acidification are also expected to contribute to cumulative impacts, though it is uncertain how they may act additively or synergistically within other IPFs and have species- and life stage-specific effects. When considered in the context of all other past, present, and reasonably foreseeable activities in the proposed OCS lease sale area, the *incremental contribution* of an OCS oil and gas lease sale in the geographic areas defined by Alternative B, C, or D to cumulative impacts on pelagic communities and habitats would be **negligible** when properly regulated. Further, although impacts from OCS oil- and gas-related activities would not be expected to occur in areas removed from potential leasing in Alternatives C and D, the areas that are part of the geographical constraint (i.e., removed from potential leasing) do not contain unique pelagic habitats or communities that differ from the remaining areas, leaving cumulative impact determinations unchanged. Therefore, an OCS oil and gas lease sale would not be expected to result in, or have a notable or measurable contribution to, any new or ongoing significant cumulative impacts not already being experienced by pelagic communities and habitats in the area of analysis.

Fishes and Invertebrates

BOEM has analyzed the potential impacts to fishes and invertebrates with regards to each of the alternatives, scenario, and IPFs. Under Alternative A, if a single proposed OCS oil and gas lease sale were cancelled, the impacts are **none** since any potential impacts to fishes and invertebrates from an OCS oil and gas lease sale would be avoided. Under Alternatives B, C, and D, an OCS oil and gas lease sale could result in **moderate adverse** impacts to fishes and invertebrates without mitigation. With the application of protective measures (i.e., BOEM hard bottom distancing mitigations), the **adverse** impacts would be reduced to **minor**. While impact conclusions are the same for Alternatives B, C, and D, Alternative C would provide greater protection than Alternative B for highly productive and diverse fish and invertebrate assemblages, including recreationally and commercially managed finfish species, known to inhabit hard bottom habitats in the region due to its exclusion of whole and partial blocks containing topographic and pinnacle trend features from leasing. Alternative D may further reduce impacts specific to coastal and estuarine fishes and invertebrates.

Baseline environmental impacts from natural and anthropogenic stressors, including commercial fishing activity, oil- and gas-related activities, military operations, sand mining, climate change-related stressors, and seasonal hypoxic zones, will continue to result in notable cumulative impacts to fishes and invertebrates, which is mostly attributable to bottom disturbances and associated mortalities (e.g., bycatch) caused by commercial fishing activities. When considered in the context of all other past, present, and reasonably foreseeable activities in the proposed OCS oil and gas lease sale area, the *incremental contribution* of an OCS oil and gas lease sale in the geographic areas defined by Alternative B, C, or D to cumulative impacts on fishes and invertebrates would be **negligible** to **minor** when properly regulated and mitigated (i.e., BOEM's hard bottom distancing mitigations). An OCS oil and gas lease sale would not be expected to result in, or have a notable or measurable contribution to, any new or ongoing significant cumulative impacts not already being experienced by fishes and invertebrates in the area of analysis.

Birds

BOEM has analyzed the potential impacts to birds with regards to each of the alternatives, the scenario, and IPFs. Under Alternative A, if a single proposed OCS oil and gas lease sale were cancelled, any potential impacts to birds from an OCS oil and gas lease sale would be **none**. Under Alternatives B, C, and D, an OCS oil and gas lease sale would result in **negligible** to **moderate adverse** impacts on birds when properly regulated, as lessees are required to perform OCS oil- and gas-related activities in accordance with regulatory requirements of all Federal and State statutes. The potential spatial redistribution of activities under Alternatives C and D would not directly or indirectly influence the impact conclusions for birds, including ESA-listed species because bird species are spatially similar across the northern GOM and under all three alternatives. Although impacts from routine OCS oil- and gas-related activities would not be expected to occur in areas removed from potential leasing in Alternatives C and D, the areas that are part of the geographical constraint (i.e., removed from potential leasing) do not contain unique bird habitats or communities that differ from the remaining areas, leaving cumulative impact determinations unchanged. Routine impacts would be limited to the areas leased under Alternatives C and D. The impacts from accidental events would be the same as described for Alternative B in **Chapter 4.7**, including vessel and aircraft strikes though unlikely, which could occur in excluded areas because vessels and aircraft could still transit the excluded areas. However, this potential spatial redistribution of activity does not affect impact levels to birds because of their wide distribution across the northern GOM.

Populations of coastal birds may continue to be stressed by exposure to noise, lighting, routine and accidental discharges, and increasing vessel traffic. Cumulative stressors that lead to the degradation or loss of key habitat areas for some birds would likely put additional stress on certain species reliant on those habitats. When considered in the context of all other past, present, and reasonably foreseeable activities in the OCS lease sale area, the *incremental contribution* of an OCS oil and gas lease sale in the geographic areas defined by Alternative B, C, or D to cumulative impacts on birds would be **negligible** when properly regulated. An OCS oil and gas lease sale would not be expected to result in, or have a notable or measurable contribution to, any new or ongoing significant cumulative impacts not already being experienced by birds in the area of analysis.

Marine Mammals

BOEM has analyzed the potential impacts to marine mammals with regards to each of the alternatives, the scenario, and IPFs. Under Alternative A, if a single proposed OCS oil and gas lease sale were cancelled, any potential impacts to marine mammals from an OCS oil and gas lease sale would be **none**. Under Alternatives B, C, and D, an OCS oil and gas lease sale could result in **negligible** to **major adverse** impacts on marine mammals. With the application of protective measures (i.e., the Topographic Features and Live Bottom (Pinnacle Trend) Stipulations; NTL No. 2009-G39; Protected Species Stipulation Pile Driving Monitoring and Reporting Requirements COA; in addition to 2020 NMFS BiOp, as amended, Slack-line Precautions COA; Moon Pool Monitoring COA; Reporting Requirements COA; Notification of Intention to Transit Rice's Whale Area COA; and Appendices A, B, C, and I (NMFS 2020b; 2021a), the impacts would be reduced to **negligible** to **moderate adverse**. Most impacts to marine mammals from routine OCS oil- and gas-related activities are not expected to occur in areas removed from potential leasing under Alternatives C and D because, as discussed under Alternative B in **Chapter 4.8**, areas of impacts from routine OCS oil- and gas-related activities occur within limited areas surrounding activity, and these activities would not occur in excluded areas. Impacts from most routine activities would be limited to the areas leased under each alternative. The impacts from accidental events would be the same as described for Alternative B in **Chapter 4.8**, including vessel strikes, which could occur in excluded areas because vessels could still transit the excluded areas. In addition, oil spills and response activities could occur in the excluded areas. However, the potential spatial redistribution of activity does not affect impact levels to marine mammals because marine mammals are widely distributed throughout the GOM.

Noise from OCS oil and gas activities, together with noise from other cumulative sources (e.g., existing vessel traffic and Navy activities), may act together to increase stress or alter the behavior of marine mammals in certain areas. As vessel traffic near major ports like Port Fourchon, LA, and Houston, TX, increases in the future, these areas would continue to be high-risk zones for marine mammals. Additionally, resource interactions with military activities are expected to continue in the GOM. When considered in the context of all other past, present, and reasonably foreseeable activities in the proposed OCS lease sale area, the *incremental contribution* of an OCS oil and gas lease sale in the geographic areas defined by Alternative B, C, or D to cumulative impacts on marine mammals would be **negligible** when properly regulated and mitigated. However, for the small, vulnerable population of Rice's whale in the GOM, the additional vessel trips associated with the proposed action may pose a small, potentially significant contribution to cumulative impacts of vessel strike to the Rice's whale.

Sea Turtles

BOEM has analyzed the potential impacts to sea turtles with regards to each of the alternatives, scenario, and IPFs. Under Alternative A, if a single OCS oil and gas lease sale were cancelled, any potential impacts to sea turtles from an OCS oil and gas lease sale would be **none**. Under Alternatives B, C, and D, an OCS oil and gas lease sale without mitigation could result in **negligible** to **moderate adverse** impacts on sea turtles. With the application of protective measures, including the Topographic Features and Live Bottom (Pinnacle Trend) Stipulations; NTL No. 2009-G39; Protected Species Stipulation; Pile Driving Monitoring and Reporting Requirements COA; in addition to 2020 NMFS BiOp, as amended by Appendix A, B, C, I, and J; the Moon Pool Monitoring COA; the Slack-line Precautions COA; and Reporting Requirements COA are utilized, the impacts would be reduced to **negligible** to **minor adverse**.

Mortality and injury due to fisheries interactions continue to be a problem for sea turtles. Historically, the shrimp trawl fishery has been particularly lethal for sea turtles, though the implementation of turtle excluder devices has helped to reduce mortality in recent years. Additionally, as vessel traffic near major ports like Port Fourchon, LA, and Houston, TX, increases in the future, these areas would continue to be high-risk zones for sea turtles. Additionally, resource interactions with military activities are expected to continue in the GOM. When considered in the context of all other past, present, and reasonably foreseeable activities in the proposed OCS lease sale area, the *incremental contribution* of an OCS oil and gas lease sale in the geographic areas defined by Alternative B, C, or D to cumulative impacts on sea turtles would be **negligible** when properly regulated and mitigated. An OCS oil and gas lease sale would not be expected to result in, or have a notable or measurable contribution to, any new or ongoing significant cumulative impacts not already being experienced by sea turtles in the area of analysis.

The exclusion of areas could provide benefits to sea turtles; however, due to the sea turtles' wide distribution and transitory use of these areas, the benefits of the exclusions would be limited. Most impacts to sea turtles from routine OCS oil- and gas-related activities are not expected to occur in areas removed from potential leasing under Alternatives C and D because, as discussed under Alternative B in **Chapter 4.9**, areas of impacts from routine OCS oil- and gas-related activities occur within limited areas surrounding activity, and these activities would not occur in excluded areas. Impacts from most routine activities would be limited to the areas leased under each alternative. The impacts from accidental events would be the same as described for Alternative B in **Chapter 4.9**, including vessel strikes, which could occur in excluded areas because vessels could still transit the excluded areas. In addition, oil spills and response activities could occur in the excluded areas. The potential spatial redistribution of activity does not affect impact levels to sea turtles because sea turtles are widely distributed throughout the GOM. However, the exposure to IPFs associated with the installation, operation, maintenance, and decommissioning of offshore OCS oil- and gas-related infrastructure could be reduced near the exclusion areas for Alternatives C and D.

Commercial Fisheries

BOEM has analyzed the potential impacts to commercial fisheries with regards to each of the alternatives, scenario, and IPFs. Under Alternative A, if a single OCS oil and gas lease sale were cancelled, any direct impacts to commercial fisheries from an OCS oil and gas lease sale would be **none**, and any indirect impacts from energy substitution as a result of a canceled lease sale would be **negligible**. Under Alternatives B-D, an OCS oil and gas lease sale could result in **minor beneficial** to **minor adverse** impacts on commercial fisheries. The actual impacts would depend on the locations of activities, species affected, intensity of commercial fishing activity in the affected area, and substitutability of any lost fishing access. From a regional perspective, routine and accidental impact conclusions under Alternatives C and D are unchanged from Alternative B. However, the removal of the Wind Leasing Call Area, waters shoreward of the 20-m (66-ft) isobath, SSRAs, and other areas in Alternative D would reduce the probability of impacts from routine activities in the majority of commercial fishing areas and could reduce the probability of some accidental events being experienced in adjacent coastal areas, especially in Texas and western Louisiana.

When considered in the context of all other past, present, and reasonably foreseeable activities in the lease sale area, the *incremental contribution* of an OCS oil and gas lease sale in the geographic areas defined by Alternatives B-D to cumulative impacts on commercial fisheries ranges from **negligible** to **minor adverse**. An OCS oil and gas lease sale would not be expected to result in, or have a notable or measurable contribution to, any new or ongoing significant cumulative impacts not already being experienced by commercial fisheries in the area of analysis. Commercial fisheries are managed by NOAA Fisheries (NMFS), as advised by the regional fisheries management councils, such as the Gulf of Mexico Fishery Management Council. Commercial fisheries are regulated by various mechanisms, including permitting, closures, quotas, and gear restrictions to mitigate cumulative effects and ensure the continued viability of commercial fisheries stocks.

Recreational Fishing

BOEM has analyzed the potential impacts to recreational fishing with regards to each of the alternatives, scenario, and IPFs. Under Alternative A, if a single OCS oil and gas lease sale were cancelled, direct impacts to recreational fishing from an OCS oil and gas lease sale would be **none,** and any indirect effects because of the precluded leasing and associated activities would be **negligible**. Under Alternative B, an OCS oil and gas lease sale could lead to **minor beneficial** to **minor adverse** impacts. Routine and accidental impacts under Alternatives C and D would remain unchanged from Alternative B, differing only in possible geographic distribution (especially with Alternative D) but not in overall activity levels. When considered in the context of all other past, present, and reasonably foreseeable activities in the lease sale area, the *incremental contribution* of an OCS oil and gas lease sale in the geographic areas defined by Alternative B, C, or D to cumulative impacts on recreational fishing would be **minor beneficial** to **minor adverse**. An OCS oil and gas lease sale would not be expected to result in, or have a notable or measurable contribution to, any new or ongoing significant cumulative impacts not already being experienced by recreational fishing in the area of analysis. Current trends in recreational fishing are expected to persist and remain relatively unchanged due to foreseeable cumulative effects.

Recreational Resources

BOEM has analyzed the potential impacts to recreational resources with regards to each of the alternatives, the scenario, and IPFs. Under Alternative A, if a single OCS oil and gas lease sale were cancelled, direct impacts to recreational resources from an OCS oil and gas lease sale would be **none**, and any indirect impacts would be **negligible**. Under Alternatives B and C, an OCS oil and gas lease sale would result in **minor beneficial** to **minor adverse** impacts on recreational resources. Under Alternative D, an OCS oil and gas lease sale would result in **negligible** impacts on recreational resources due to the removal of much of the lease sale area near recreational resources along the coastline. When considered in the context of all other past, present, and reasonably foreseeable activities in the lease sale area, the *incremental contribution* of an OCS oil and gas lease sale in the geographic areas defined by Alternative B, C, or D to cumulative impacts on recreational resources would be **negligible**. An OCS oil and gas lease sale would not be expected to result in, or have a notable or measurable contribution to, any new or ongoing significant cumulative impacts not already being experienced by recreational resources in the area of analysis.

Cultural, Historical, and Archaeological Resources

BOEM has analyzed the potential impacts to cultural, historical, and archaeological resources with regards to each of the alternatives, scenario, and IPFs. Under Alternative A, if a single OCS oil and gas lease sale were cancelled, any potential impacts to cultural, historical, and archaeological resources from an OCS oil and gas lease sale would be **none**. Under Alternatives B, C, and D, an OCS oil and gas lease sale could result in **negligible** to **major** negative impacts to cultural, historical, and archaeological resources. With the application of archaeological survey requirements and other protective measures as outlined in **Table 4.13-2**, the impacts would be reduced to **negligible** to **minor**.

Oil and gas infrastructure that has been determined to potentially adversely affect historic properties since the passage of the NHPA, in theory, have been sufficiently mitigated. Thus, while the cumulative lighting and visual impacts of oil and gas infrastructure is significant, ongoing adverse effects to specific historic properties (i.e., that have not been mitigated) would be limited. When considered in the context of all other past, present, and reasonably foreseeable activities in the lease sale area and existing regulatory requirements, the *incremental contribution* of an OCS oil and gas lease sale in the geographic areas defined by Alternative B, C, or D to cumulative impacts on cultural, historical, and archaeological resources would be **negligible**. An OCS oil and gas lease sale would not be expected to result in, or have a notable or measurable contribution to, any new or ongoing significant cumulative impacts not already being experienced by cultural, historical, and archaeological resources in the area of analysis. Furthermore, archaeological surveys conducted in support of oil and gas exploration and development activities has been the primary means through which BOEM has identified known and potential archaeological resources on the Gulf of Mexico OCS. The cessation of future surveys in unleased and unexplored areas could limit BOEM's awareness of the presence or absence of potential archaeological resources in unleased blocks and, consequently, the information that would be available to other Federal and State agencies to inform the protection of those resources during non-OCS oil- and gas-related activities (i.e., cumulative activities) or during response activities associated with accidental events.

Land Use and Coastal Infrastructure

BOEM has analyzed the potential impacts to land use and coastal infrastructure with regards to each of the alternatives, scenario, and IPFs. Under Alternative A, if a single OCS oil and gas lease sale were cancelled, any potential impacts to land use and coastal infrastructure from an OCS oil and gas lease sale would be **none**. Under Alternatives B, C, and D, an OCS oil and gas lease sale could result in **minor beneficial** to **moderate adverse** impacts on land use and coastal infrastructure. When considered in the context of all other past, present, and reasonably foreseeable activities in the lease sale area, the *incremental contribution* of an OCS oil and gas lease sale in the geographic areas defined by Alternative B, C, or D to cumulative impacts on coastal land use and infrastructure would be **negligible**. Onshore areas in the Western and Central GOM Planning Areas host an expansive network of oil and gas infrastructure industry. An OCS oil and gas lease sale would not be expected to result in, or have a notable or measurable contribution to, any new or ongoing significant cumulative impacts not already being experienced by land use and coastal infrastructure in the area of analysis. Land use may be altered by industrial development, which is likely to continue for the foreseeable future as coastal areas adapt to ever-changing land use needs. Ongoing oil and gas activities onshore and in both Federal and state waters are expected to continue to be supported by existing onshore infrastructure facilities (e.g., processing, construction, shipbuilding).

Economic Factors

BOEM has analyzed the potential impacts on economic factors in relation to each of the alternatives, scenario, and IPFs. If Alternative A was implemented and a single OCS oil and gas lease sale were cancelled, any potential adverse impacts to economic factors would range from **negligible** in the short-term to potentially **moderate adverse** in the long-term, depending on how industry views and responds to that decision moving forward. Under Alternatives B, C, and D, an OCS oil and gas lease sale could result in **minor** to **moderate beneficial** impacts on economic factors depending on the actual levels of production and associated exploration and development activity (refer to **Chapter 3.3**). If actual activities resulting from the proposed action resemble the low-case scenario, then the beneficial impacts would likely be **minor**, mostly sustaining existing economic conditions or resulting in a small but measurable economic improvement. If actual activities resulting from an OCS oil and gas lease sale resemble the mid- to high-case scenario, however, the beneficial impacts could be up to **moderate**, resulting in a notable and measurable economic improvement. Accidental events that result from an OCS oil and gas lease sale could range from **negligible** to **moderate adverse** under Alternatives B-D. Alternative C or D entails conducting the same level of the OCS oil- and gas-related activities as proposed under Alternative B. Therefore, the overall impact conclusions for Alternatives C and D are the same as for Alternative B. When considered in the context of all other past, present, and reasonably foreseeable activities in the lease sale area, the *incremental contribution* of an OCS oil and gas lease sale in the geographic areas defined by Alternative B, C, or D to cumulative impacts on economic factors would be **minor** to **moderate beneficial**. New projects from an OCS oil and gas lease sale would more likely provide continued work for the existing workforce rather than create new jobs. Conversely, the incremental impacts from the cancellation of a single OCS oil and gas lease sale could result in **negligible** to **moderate adverse** cumulative effects to the GOM's long-term economic prospects depending on how industry responds (**Chapter 2.2.1**).

Social Factors (Including Environmental Justice)

BOEM has analyzed the potential impacts to social factors with regards to each of the alternatives, scenario, and IPFs described in **Chapter 3**. Under Alternative A, if a single OCS oil and gas lease sale were cancelled, impacts would be **negligible**. Under Alternatives B-D, routine activities could lead to **minor beneficial** to **negligible adverse** impacts, while accidental events could have **negligible** to **moderate adverse** impacts. Though the removal of the wind leasing areas, SSRAs, and other areas under Alternatives C and D (**Figures 2.2-2 and 2.2-3**) could potentially reduce the probability of some accidental events being experienced in adjacent coastal areas, especially in Texas and western Louisiana, vessel traffic and pipelines would still be present. Therefore, overall routine and accidental impact conclusions under Alternatives C and D are unchanged from Alternative B.

The *incremental impact* of an OCS oil and gas lease sale to cumulative impacts, across all action alternatives, would be **minor adverse** given the mature and expansive existing OCS Oil and Gas Program and infrastructure and its deeply intertwined nature to the regional communities and economies of the five Gulf Coast States. The oil and gas industry has matured over nearly a century and is well-developed, expansive, extensive, and deeply intertwined in the regional communities and economies of the Gulf Coast States. Therefore, an OCS oil and gas lease sale would not be expected to result in, or have a notable or measurable contribution to, any new or ongoing significant cumulative impacts not already being experienced by social factors in the area of analysis. Social factors likely would continue to be impacted by intersecting factors related to economic conditions, land use decisions, land loss and subsidence, and other cumulative social drivers.

Environmental Justice Determination: In accordance with 40 CFR §§ 1508.7 and 1508.8, BOEM has considered potential cumulative, direct, and indirect impacts to minority and low-income populations in the analysis area. Most of the OCS oil- and gas-related activities as a result of an OCS oil and gas lease sale are distant from human habitation and would not have any direct impacts on low-income and minority populations. Indirect impacts to minority and low-income populations would occur onshore and would result from the operations of the extensive infrastructure system that supports all onshore and offshore OCS oil- and gas-related activities. Many other Federal and State agencies regulate onshore oil- and gas-related infrastructure through air and wastewater discharge permitting and stream and wetland permitting, which must also consider environmental justice impacts. Therefore, BOEM has determined that a proposed oil and gas lease sale would not directly adversely affect minority and low-income populations. However, indirect impacts might interact with other cumulative burdens unevenly throughout the study region and could potentially affect environmental justice populations, although the particular contributions of an OCS oil and gas lease sale cannot measurably be determined with available information in regard to the location, extent, or severity of these impacts. Refer to **Chapter 4.16** for greater detail.

Summary of Cumulative Impacts

Multiple IPFs are likely to affect GOM resources in the coming decades, including but not limited to, invasive species, nutrient runoff and pollution, marine traffic, coastal development, military and other Federal activities, climate change, and ongoing and future OCS oil- and gas-related activities. For example, noise from deep-penetration seismic surveys or decommissioning may disturb or injure marine mammals, sea turtles, and fish. Lingering effects from the *Deepwater Horizon* explosion, oil spill, and response, as well as increased ocean temperature and acidity, may challenge many marine and estuarine communities, including coral reefs and other hard-bottom benthic communities. Commercial and recreational fishing may impact some benthic communities, levels of harvested fish species, and bycatch. Rising demand for sand and increased dredging may degrade benthic communities and may disturb, injure, or kill sea turtles. Coastal and estuarine habitats along the Gulf Coast may be subjected to runoff and pollution, which may degrade water quality. Increases in vessel traffic, coastal development, and sea-level rise may influence coastal erosion. Coastal habitats and communities (particularly wetlands) are threatened by subsidence, erosion, sediment starvation, and sea-level rise. Tourism is expected to continue to be an important driver, though more so in the EPA, where OCS oil- and gas-related activities are far less prevalent and activities related to future OCS oil and gas lease sales are not reasonably foreseeable (BOEM 2023b).

In general, BOEM expects fewer new facilities across the GOM shelf and deepwater environment as a result of future OCS oil and gas leasing when compared to historical trends, with deepwater facilities yielding most of the oil production. Additionally, advances in upstream and downstream technology could potentially change the level of projected OCS oil- and gas-related activities for future OCS oil and gas lease sales and how they are conducted. Based on the scenario projections in **Chapter 3.3**, it is reasonable to assume the future effects from the Cumulative OCS Oil and Gas Program would likely be similar to those in the past and under existing conditions. An OCS oil and gas lease sale would not be expected to result in, or have a notable or measurable contribution to, any new or ongoing significant cumulative impacts not already being experienced by most resources in the area of analysis, including coastal communities and habitats, benthic communities and habitats, pelagic communities and habitats, fish and invertebrates; birds; commercial fisheries; recreational fishing; recreational resources; cultural, historical, and archaeological resources; land use and coastal infrastructure; and social factors (see **Chapter 4.17**).

The incremental contribution of an OCS oil and gas lease sale's impacts to air quality could result in **moderate** to **major** cumulative air quality impacts if notable and measurable levels of O_3 caused by the proposed action were to reach the Houston-Galveston-Brazoria area, thus slowing down the long-term ability of the area to recover from the chronic nonattainment status for O_3 currently experienced. There are several existing regulatory programs and requirements in place, however, to reduce or minimize cumulative impacts to air quality in the GOM at all stages of OCS oil and gas development (**Table 4.1-2**). Therefore, additional or worsened significant cumulative impacts to air quality as a result of an OCS oil and gas lease sale, though possible, would not be likely. Routine activities and the most likely types of accidental events expected as a result of an OCS oil and gas lease sale would not be expected to result in, or have a notable or measurable contribution to, any new or ongoing significant cumulative impacts to water quality. However, there is the potential for a large spill (e.g., ≥1,000 bbl) to result in up to **moderate** cumulative impacts to water quality depending on the characteristics of the spill, baseline conditions at the time of the event, and weather and oceanographic conditions, among other variables. Refer to the GOM Catastrophic Spill Event Analysis technical report (BOEM 2021c) for an assessment of potential impacts resulting from a low-probability catastrophic spill in the GOM similar in nature to the *Deepwater Horizon* explosion, oil spill, and response, which is not part of the action alternatives.

Impacts from an OCS oil and gas lease sale due to noise, entanglement, unintended releases (oil spills), and vessel strikes could potentially result in **moderate** to **major** cumulative impacts to marine mammals and sea turtles if not mitigated. However, with the application of mitigating measures, stipulations, and consultation requirements (refer to **Tables 4.8-2 and 4.9-2**), these impacts would likely be **negligible** to **moderate** and not expected to result in, or have a notable or measurable contribution to, any new or ongoing significant cumulative impacts to marine mammals or sea turtles. The exception would be if a vessel associated with an OCS oil and gas lease sale were to strike an ESA-listed species and result in population-level effects to the extent that the viability of the population was diminished. The Notification of Intention to Transit Rice's Whale Area COA avoids or mitigates potential vessel interactions with Rice's whales in the northeastern GOM. Furthermore, additional mitigating measures through ESA consultation may be applied as part of an OCS oil and gas lease sale or during post-lease reviews.

Generally, a single OCS oil and gas lease sale would have a **minor** to **moderate beneficial** contribution to cumulative economic impacts given the substantial prevalence and influence of OCS oil- and gas-related activities to the regional economy (particularly in Louisiana and Texas). New projects from an OCS oil and gas lease sale would provide continued work for the existing workforce more so than create new jobs. Conversely, the incremental impacts from the cancellation of a single OCS oil and gas lease sale could result in **minor** to **moderate adverse** cumulative effects to the GOM's long-term economic prospects, depending on how industry responds (**Chapter 2.2.1**). Overall, global emissions would likely increase in each activity level under the action alternatives (refer to **Appendix H**). However, BOEM acknowledges the limitations and uncertainty in the modeling and what implications the incremental contribution to global GHGs might have to cumulative impacts from future climate change.

Appendix A – Consultation and Coordination

This appendix summarizes the ongoing consultation and coordination efforts used in preparing this Draft Programmatic EIS. This includes a description of the Call for Information and Area Identification memorandum. A summary of efforts from public scoping and consultations with Tribal governments, and Federal and State agencies under the Coastal Zone Management Act, Endangered Species Act, Magnuson-Stevens Fishery Conservation and Management Act, National Historic Preservation Act, and government-to-government consultation and coordination are included. A scoping report, entitled *Scoping Summary Report for the Gulf of Mexico Regional OCS Oil and Gas Lease Sales Programmatic EIS* (ICF International 2024), summarizing the submissions received and the methods for analyzing them is available on BOEM's website at https://www.boem.gov/sites/default/files/documents/environment/environmental-assessment/BOEM-2023-0046_GOM%20PEIS%20Scoping%20Summary.pdf. In addition, all public scoping comments received can be viewed online at http://www.regulations.gov by typing "BOEM-2023-0046" in the search field. As detailed in *Scoping Summary Report for the Gulf of Mexico Regional OCS Oil and Gas Lease Sales Programmatic EIS* (ICF International 2024), the resource areas or NEPA topics most referenced in the scoping comments were the purpose and need, alternatives, mitigation, climate change and greenhouse gases, space-use conflicts, air and water quality, fish, marine mammals (including Rice's whale), sea turtles, commercial fishing, socioeconomics factors, cumulative effects, oil spills, and regulations and safety.

Appendix B – References

This appendix includes all the citations referenced throughout this Draft Programmatic EIS.

Appendix C – List of Preparers

This appendix provides a list of all the preparers of this Draft Programmatic EIS.

Appendix D – Glossary

This appendix is a glossary of terms used throughout this Draft Programmatic EIS.

Appendix E – Consultation Correspondence

This appendix collects the letters associated with the various consultations.

Appendix F – Proposed Lease Mitigating Measures

This appendix details proposed lease stipulations.

Appendix G – State Coastal Management Plans

This appendix includes descriptions of the Coastal Management Plans for each of the Gulf Coast States.

Appendix H – Gulf of Mexico OCS Oil and Gas Leasing Greenhouse Gas Emissions and Social Costs Analysis

This appendix includes an updated life-cycle GHG emissions and social cost of GHG emissions analysis.

Appendix I – Keyword Index

This appendix is an index of key words used throughout this Draft Programmatic EIS.

Appendix J – Decommissioning

This appendix includes expanded descriptions of decommissioning activities.

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ABBREVIATIONS AND ACRONYMS

µg	microgram
µm	micrometer
2024-2029 National OCS Oil and Gas Program	*2024-2029 National Outer Continental Shelf Oil and Gas Leasing: Proposed Final Program*
2024-2029 National OCS Oil and Gas Program Programmatic EIS	*2024-2029 National Outer Continental Shelf Oil and Gas Leasing Program: Final Programmatic Environmental Impact Statement*
2D	two dimensional
3D	three dimensional
4D	four dimensional
ac	acre
AUV	autonomous underwater vehicle
AQRV	air quality-related value
Agreement	Agreement between the United States of America and the United Mexican States Concerning Transboundary Hydrocarbon Reservoirs in the Gulf of Mexico
Area ID	Area Identification
bbl	barrel
Bcf	billion cubic feet
BBO	billion barrels of oil
BOE	billion barrels of oil equivalent
Bbbl	billion barrels
BEBR	*Biological Environmental Background Report for the Gulf of Mexico OCS Region*
BOEM	Bureau of Ocean Energy Management
BSEE	Bureau of Safety and Environmental Enforcement
BTEX	benzene, toluene, ethylbenzene, and xylene
BOEMRE	Bureau of Ocean Energy Management, Regulation and Enforcement
Call	Call for Information
CAMx	Comprehensive Air-quality Model with extensions
CD	Consistency Determination
CG	Coast Guard (also: USCG)
CO	carbon monoxide
CH_4	methane
CO_2	carbon dioxide
CAP	criteria air pollutant
CEQ	Council on Environmental Quality

CFR	Code of Federal Regulations
CMP	Coastal Management Program
COA	conditions of approval
COE	Corps of Engineers (U.S. Army)
CPA	Central Planning Area
CO_2e	CO_2 equivalent
CMAQ	Community Multiscale Air Quality
COST	continental offshore stratigraphic test
CSEM	controlled source electromagnetic
CZMA	Coastal Zone Management Act
CHIRP	compressed high-intensity radar pulse
CONUS	contiguous U.S.
DOI	Department of the Interior (U.S.) (also: USDOI)
DOT	Department of Transportation (U.S.) (also: USDOT)
DPP	development and production plan
DOCD	development operations coordination document
e.g.	for example
EA	environmental assessment
EP	exploration plan
ECS	Extended Continental Shelf
EFH	essential fish habitat
EIA	Economic Impact Area
EIS	environmental impact statement
EPA	Eastern Planning Area
ESA	Endangered Species Act of 1973
et al.	and others
et seq.	and the following
ft	foot
FR	*Federal Register*
FWS	U.S. Fish and Wildlife Service
FPSO	floating production, storage, and offloading system
FGBNMS	Flower Garden Banks National Marine Sanctuary
G&G	geological and geophysical
GDP	gross domestic product
GHG	greenhouse gas
GOM	Gulf of Mexico
GWEI	Gulfwide Emission Inventory
GOADS	Gulfwide Offshore Activity Data System

GOMESA	Gulf of Mexico Energy Security Act
GOM Oil and Gas SID	*Programmatic Description of the Potential Effects from Gulf of Mexico OCS Oil- and Gas-Related Activities: A Supporting Information Document*
GOM Catastrophic Spill Event Analysis	*Gulf of Mexico Catastrophic Spill Event Analysis: High-Volume, Extended-Duration Oil Spill Resulting from Loss of Well Control on the Gulf of Mexico Outer Continental Shelf; 2nd Revision*
GOM Oil and Gas Programmatic EIS	*Gulf of Mexico Regional Oil and Gas Lease Sales: Draft Programmatic Environmental Impact Statement*
Gulf of Mexico G&G Programmatic EIS	*Gulf of Mexico OCS Proposed Geological and Geophysical Activities: Western, Central, and Eastern Planning Areas – Final Programmatic Environmental Impact Statement*
ha	hectare
Hz	Hertz
H_2S	hydrogen sulfide
HAP	hazardous air pollutant
HRG	high-resolution geophysical
i.e.	that is
IPCC	Intergovernmental Panel on Climate Change
IPF	impact-producing factor
IRA	Inflation Reduction Act of 2022
ITL	Information to Lessees
IWG	Interagency Working Group
km	kilometer
LA	Louisiana
LCA	Louisiana Coastal Area
LNG	liquefied natural gas
LOOP	Louisiana Offshore Oil Port
m	meter
mi	mile
mm	millimeter
mg/L	milligrams/liter
MMbbl	million barrels
MMP	Marine Minerals Program
MMS	Minerals Management Service
MATS	Modeled Attainment Test Software
MMPA	Marine Mammal Protection Act
MODU	mobile offshore drilling unit

MARAD	Maritime Administration (U.S. Department of Transportation)
MAG-PLAN	MMS Alaska-GOM Model Using IMPLAN
nmi	nautical mile
N.	north
N_2O	nitrous oxide
NH_3	ammonia
NO_2	nitrogen dioxide
NO_x	nitrogen oxides
NOI	Notice of Intent
NTL	Notice to Lessees and Operators
NASA	National Aeronautics and Space Administration
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NRDA	Natural Resource Damage Assessment
NAAQS	National Ambient Air Quality Standards
NPDES	National Pollutant Discharge Elimination System
O_3	ozone
O&G	oil and gas
OCS	Outer Continental Shelf
OSV	offshore support vessel
OSHA	Occupational Safety and Health Administration
OSRA	Oil Spill Risk Analysis
OSRP	oil-spill response plan
OCSLA	Outer Continental Shelf Lands Act
ODMDS	ocean dredged-material disposal site
ppb	parts per billion
ppm	parts per million
Pb	lead
PM	particulate matter
$PM_{2.5}$	particulate matter less than or equal to 2.5 μm
PM_{10}	particulate matter less than or equal to 10 μm
PBR	Potential Biological Removal
PSD	Prevention of Significant Deterioration
PIES	Pressure Inverted Echo Sounders
PDARP/PEIS	*Deepwater Horizon Oil Spill: Programmatic Damage Assessment and Restoration Plan and Final Programmatic Environmental Impact Statement*

RCP	Representative Concentration Pathways
REN	Renewable Energy Program
ROD	Record of Decision
ROV	remotely operated vehicle
RUE	rights-of-use and easement
SC	source category
SO_2	sulphur dioxide
SO_x	sulphur oxides
SBF	synthetic-based fluid
SCC	social cost of carbon
SCM	social cost of methane
SCN	social cost of nitrous oxide
SWD	seismic while drilling
SSRA	Significant Sediment Resource Area
SC-GHG	social cost of greenhouse gases
Secretary	Secretary of the Interior
Tcf	trillion cubic feet
TPY	tons per year
Trustees	Natural Resource Damage Assessment Trustees
Transboundary Stipulation	Stipulation on the Agreement Between the United States of America and the United Mexican States Concerning Transboundary Hydrocarbon Reservoirs in the Gulf of Mexico
U.S.	United States
U.S.C.	United States Code
UME	unusual mortality event
USCG	U.S. Coast Guard (also: CG)
USGS	U.S. Geological Survey
USDHS	U.S. Department of Homeland Security
USDOC	U.S. Department of Commerce
USDOE	U.S. Department of Energy
USDOI	U.S. Department of the Interior (also: DOI)
USDOT	U.S. Department of Transportation (also: DOT)
USEPA	U.S. Environmental Protection Agency
VGP	Vessel General Permit
VOC	volatile organic compound
VSP	vertical seismic profiling
VIDA	Vessel Incidental Discharge Act
W.	west

WAZ	wide azimuth
WEA	Wind Energy Area
WPA	Western Planning Area
WRF	Weather and Research Forecasting
yr	year

CONVERSION CHART

To convert from	To	Multiply by
centimeter (cm)	inch (in)	0.3937
millimeter (mm)	inch (in)	0.03937
meter (m)	foot (ft)	3.281
meter^2 (m^2)	foot^2 (ft^2)	10.76
meter^2 (m^2)	yard^2 (yd^2)	1.196
meter^2 (m^2)	acre (ac)	0.0002471
meter^3 (m^3)	foot^3 (ft^3)	35.31
meter^3 (m^3)	yard^3 (yd^3)	1.308
kilometer (km)	mile (mi)	0.6214
kilometer^2 (km^2)	mile^2 (mi^2)	0.3861
hectare (ha)	acre (ac)	2.47
liter (L)	gallons (gal)	0.2642
degree Celsius (°C)	degree Fahrenheit (°F)	°F = (1.8 x °C) + 32

1 barrel (bbl) = 42 gal = 158.9 L = approximately 0.1428 metric tons
1 nautical mile (nmi) = 1.15 mi (1.85 km) or 6,076 ft (1,852 m)
tonnes = 1 long ton or 2,240 pounds (lb)

CHAPTER 1

PURPOSE AND NEED

1 PURPOSE AND NEED

1.1 INTRODUCTION

The Secretary of the Interior (Secretary) designated the Bureau of Ocean Energy Management (BOEM) as the administrative agency responsible for leasing submerged Outer Continental Shelf (OCS) lands for oil and gas production and for supervision of certain offshore operations after lease issuance. BOEM is responsible for managing development of the Nation's offshore mineral and energy resources in an environmentally and economically responsible way. BOEM's responsibilities include leasing; plan administration; environmental studies, consultations, and analyses in compliance with the National Environmental Policy Act (NEPA) and other statutes; resource evaluation; economic analysis; and administration of the OCS Marine Minerals and Renewable Energy Programs.

The Secretary of the Interior approved the *2024-2029 National Outer Continental Shelf Oil and Gas Leasing: Proposed Final Program* (2024-2029 National OCS Oil and Gas Program) by signing a combined Decision Memorandum and Record of Decision for the Programmatic Environmental Impact Statement for the 2024-2029 National OCS Oil and Gas Program on December 14, 2023. The 2024-2029 National OCS Oil and Gas Program provides a framework and general guide for leasing during the Program's term. However, the Secretary has discretion under the Outer Continental Shelf Lands Act (OCSLA) and other applicable laws to determine whether and when to hold individual proposed OCS oil and gas lease sales (lease sales) (43 U.S.C. § 1344(e)). BOEM conducts region-specific environmental reviews by Program Areas (i.e., the portions of the OCS planning areas that remain in consideration for leasing in a National OCS Oil and Gas Program) to support decisions on individual lease sales in those areas.

The *Gulf of Mexico Regional OCS Oil and Gas Lease Sales: Draft Programmatic Environmental Impact Statement* (GOM Oil and Gas Programmatic EIS) examines a proposed Federal action to hold an oil and gas lease sale offered in Federal OCS waters. The lease sale may be within BOEM's Gulf of Mexico (GOM) Western, Central, and Eastern Planning Areas (i.e., WPA, CPA, and EPA, respectively). These planning areas encompass the areas offshore Texas, Louisiana, Mississippi, Alabama, and Florida **(Figure 1.1-1**). BOEM chose, at its discretion, to prepare an EIS at this stage. This Programmatic EIS analyzes the potential environmental impacts that could result if BOEM authorizes exploration, development, production, and decommissioning activities in the future. This Programmatic EIS analysis provides the context and setting of future proposed actions and describes the potential impacts associated with these activities, as well as the cumulative impacts on GOM resources. This allows more time to conduct public involvement and to evaluate potential impacts, thus providing more informed potential OCS oil and gas lease sale decisions. In addition, BOEM can tier from this Programmatic EIS for site-specific reviews for potential authorizations, which will streamline those future NEPA processes. This Programmatic EIS incorporates by reference and updates relevant materials as described below in **Chapter 1.6** (refer to **Table 1.6-1**).

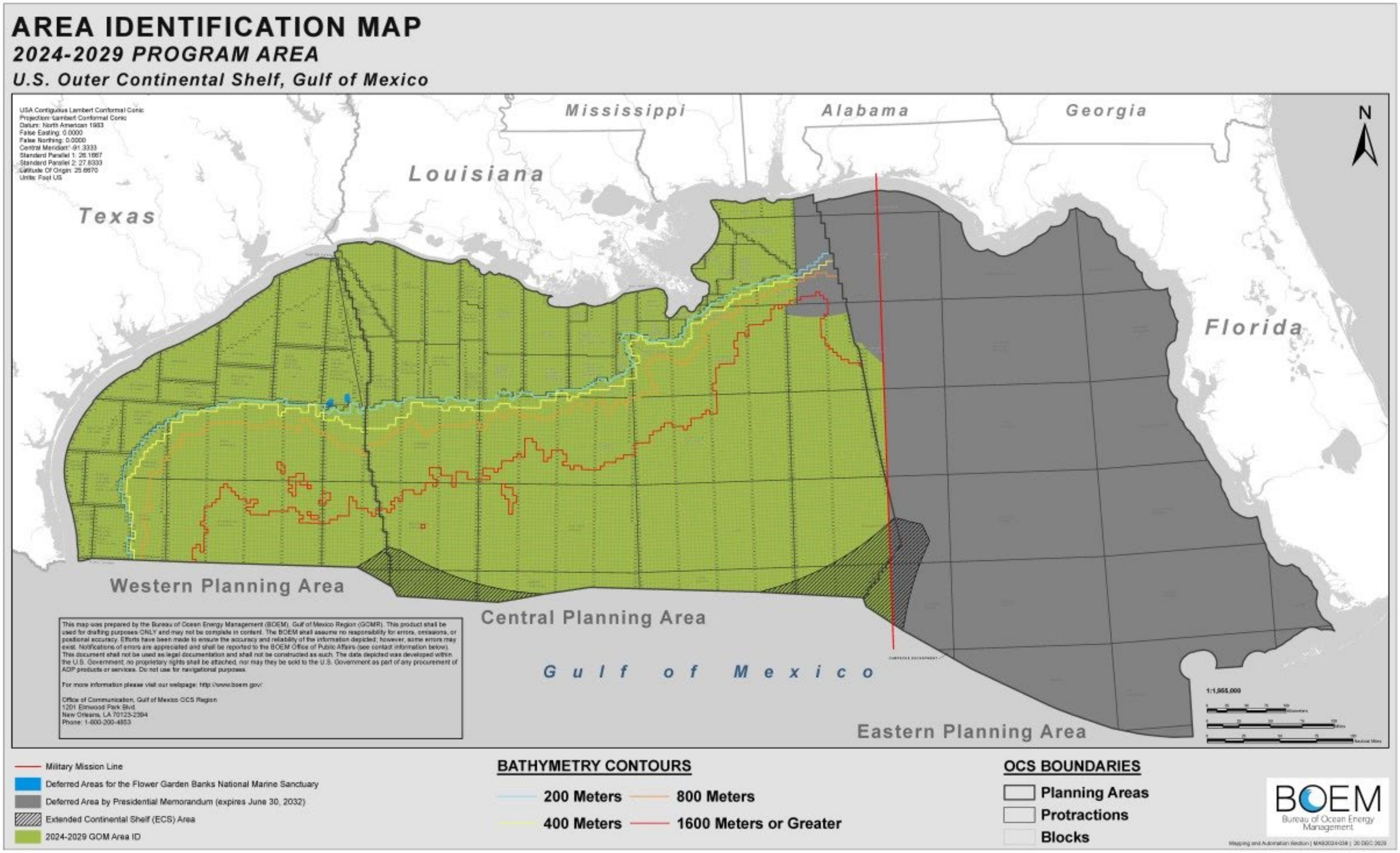

Figure 1.1-1. Area Identification Map for the 2024-2029 Proposed Gulf of Mexico Oil and Gas Lease Sales. (More information regarding the 2024-2029 GOM Area Identification can be found at https://www.boem.gov/oil-gas-energy/national-program/2024-2029-gom-area-identification. A full-sized version of this map is available online at https://www.boem.gov/sites/default/files/documents/oil-gas-energy/2024-2029%20Sales%20GOM%20Area%20ID%20Map.pdf.)

1.2 Proposed Action

The Proposed Action evaluated in this Programmatic EIS is to hold an oil and gas lease sale on the Federal OCS in the GOM (**Chapter 2.2.2**). This Programmatic EIS is expected to be used to inform the decision on whether and how to proceed for the first proposed GOM oil and gas lease sale scheduled in the 2024-2029 National OCS Oil and Gas Program. BOEM may also rely on this Programmatic EIS or supplement it as appropriate for decisions on future proposed GOM oil and gas lease sales that will be made in the normal course. BOEM may also tier from this Programmatic EIS in future NEPA reviews for associated site- and activity-specific OCS oil- and gas-related activity approvals (typically environmental assessments [EAs] for plan approvals), and to help inform extraordinary circumstance reviews to ensure categorical exclusions are used appropriately. This GOM Oil and Gas Programmatic EIS focuses its analysis on the reasonably foreseeable environmental effects of OCS oil and natural gas leasing and associated OCS oil- and gas-related activities from a representative proposed single OCS oil and gas lease sale in the GOM.

Pursuant to the OCSLA's staged leasing process, BOEM makes individual decisions on whether and how to proceed for each OCS oil and gas lease sale proposed in the 2024-2029 National OCS Oil and Gas Program. BOEM has prepared this Programmatic EIS under 40 CFR §1502.4(a) and §1502.4(b)(1)(i)-(ii) to analyze the impacts of oil and natural gas leasing and associated OCS oil- and gas-related activities. Therefore, this Programmatic EIS examines impacts from a representative, single proposed oil and gas lease sale on the Gulf of Mexico OCS. BOEM developed hypothetical scenarios on the foreseeable level of routine activities and their potential impacts, including accidental events (such as oil spills) that might result from an OCS oil and gas lease sale. A single proposed OCS oil and gas lease sale scenario includes all of the resulting activities that could occur over a 40-year analysis period. BOEM considers activities and impacts associated with an OCS oil and gas lease sale on biological, physical, and socioeconomic resources in the analysis. This Programmatic EIS assists decisionmakers in making informed, future decisions regarding GOM oil and gas leasing and site- and activity-specific OCS oil- and gas-related activities. Decisions on future proposed OCS oil and gas lease sales and site- and activity-specific OCS oil- and gas-related activities will be made in the normal course and may be based on additional NEPA review that may update this Programmatic EIS as appropriate.

1.3 Purpose of and Need for the Proposed Action

The purpose of the Proposed Action (Alternative B) is to facilitate the potential development of those areas that may contain economically recoverable oil and gas. Such post-lease development would occur through plan and permit approvals (subject to additional environmental review and regulatory oversight). This purpose is consistent with BOEM's mandate to further the orderly development of OCS oil and gas resources under the OCSLA (43 U.S.C. §§ 1331 *et seq.*). Each individual proposed OCS oil and gas lease sale would provide qualified bidders the opportunity to bid upon and lease available acreage in the Gulf of Mexico in order to explore, develop, and produce oil and natural gas.

The Proposed Action is needed to address the ongoing domestic demand for oil and gas resources and, per current law, to facilitate the development of offshore wind as a source of renewable electricity. Although the United States consumes more than just oil and natural gas to fulfill its demand for energy, these fuels currently are fundamental to powering the U.S. economy. Oil serves as the feedstock for liquid hydrocarbon products, including gasoline, aviation and diesel fuel, and various petrochemicals. Gas is used to heat homes, generate electricity, and as a feedstock necessary for the production of numerous other goods. Oil and gas from the Gulf of Mexico OCS contributes to meeting domestic demand and enhances national economic security by reducing the need for imports of these resources. A recent study, Zeringue et al. (2022), forecasts steady oil production growth in the GOM, reaching consecutive peak production rates from 2023 through 2027 at more than 2 million barrels per day. Near-term production growth is driven by several large, announced discoveries that are expected to come online between 2022 and 2025. Additions to oil production for the last 5 years of the forecast (2027-2031) rely on an increasing contribution from undiscovered resources (Zeringue et al. 2022, Figure 14). Of the 2,359 active leases (12,748,272 acres) in the GOM as of May 2024, 502 leases are in producing status, with 477 producing leases in the CPA and 25 producing leases in the WPA. BOEM's short-term forecast shows strong continued production in the GOM. Although leasing decisions made in the 2024-2029 National OCS Oil and Gas Program would not result in new production for several years, the developments and production would contribute to the national energy needs by contributing supply as well as benefits in terms of the balance of payments, energy security, technology, revenues, and employment.

Additionally, under the Inflation Reduction Act of 2022 (Public Law 117-169, enacted August 16, 2022), Congress has directed that the Secretary of the Interior must hold an offshore oil and gas lease sale(s) totaling a minimum aggregate of 60 million acres in the year prior to issuing any offshore wind energy leases. The long-term goal of the Biden Administration is to reach net-zero greenhouse gas (GHG) emissions by 2050 and to limit global warming to less than 1.5° Celsius (2.7° Fahrenheit). The Administration also established goals of a 50 percent reduction of 2005 emissions by 2030 and a carbon pollution-free power sector by 2035 (The White House 2021). To meet these targets, the U.S. would have to drastically change both the way it supplies and also consumes energy. These changes would require an increase in renewable energy production, electrification, and energy efficiency, and also reduced consumption from less reliance on oil and gas resources and reduced demand. The U.S. is striving to make these changes by increasing renewable energy production, especially offshore wind. Offshore wind energy is a key feature of the Biden Administration's plans to reduce future GHG emissions. Therefore, continued OCS oil and gas lease sales are required to pursue the climate-related goals of the Biden Administration. Refer to Chapter 1.2 of the 2024-2029 National OCS Oil and Gas Program for details on energy needs in the United States and to Chapter 6 for details on national and regional energy markets (BOEM 2023c).

1.4 Gulf of Mexico Post-Lease Activities

BOEM and the Bureau of Safety and Environmental Enforcement (BSEE) are responsible for managing, regulating, and monitoring oil and natural gas exploration, development, production, and decommissioning operations on the OCS to promote the orderly development of mineral resources in a safe and environmentally sound manner. BOEM's regulations for oil, gas, and sulphur lease operations are specified in 30 CFR parts 550, 551, 556, and 560. BSEE's regulations for oil, gas, and sulphur operations are specified in 30 CFR parts 250 and 254. In 2018, BOEM and BSEE signed a Memorandum of Agreement (MOA) to outline each Bureau's NEPA responsibilities (BOEM and BSEE 2018). The MOA established that BOEM will manage the NEPA process for BSEE actions and that BSEE will serve as a Cooperating Agency on BOEM-initiated NEPA documents. The analysis presented in this Programmatic EIS will help inform decisions for site- and activity-specific OCS oil- and gas- related activities. Site- and activity-specific NEPA documents (typically EAs for plan approvals) can tier from this Programmatic EIS. Extraordinary circumstance reviews can draw from this Programmatic EIS to ensure that categorical exclusions are used appropriately. All plans for OCS oil- and gas-related activities (e.g., exploration and development plans) go through rigorous BOEM review and approval to ensure compliance with established laws and regulations before any project-specific activities can begin on a lease. Refer to **Chapter 3.2** for descriptions of these post-lease activities. BOEM and BSEE may assign mitigating measures as conditions of approval or permitting based on BOEM's and BSEE's technical and environmental evaluations of the proposed operations and may be applied to any OCS plan, permit, right-of-use and easement, or pipeline right-of-way grant. Refer to Chapters 6 and 7 of the *Programmatic Description of the Potential Effects from Gulf of Mexico OCS Oil- and Gas-Related Activities: A Supporting Information Document* (GOM Oil and Gas SID) (BOEM 2023e) for more information on the mitigating measures that BOEM and BSEE often apply to permits and approvals. Operational compliance of the mitigating measures is enforced through BSEE's office and field compliance verification and inspection program.

BOEM and BSEE issue Notices to Lessees and Operators (NTLs) to provide clarification, description, or interpretation of a regulation; provide guidelines on the implementation of a special lease stipulation or regional requirement; or convey administrative information. A detailed listing of the current Gulf of Mexico OCS region's NTLs is available through BOEM's Gulf of Mexico Regional Office's website at http://boem.gov/Regulations/Notices-Letters-and-Information-to-Lessees-and-Operators.aspx or through the Gulf of Mexico Regional Office, Office of Communications at 504-736-2519 or 1-800-200-GULF. A detailed listing of BSEE's Gulf of Mexico OCS Region's current NTLs is available through BSEE's website at https://www.bsee.gov/guidance-and-regulations/guidance/notice-to-lessees.

1.5 Regulatory Framework

The OCSLA mandates preparation of a national OCS oil and gas leasing program, and both the OCSLA and NEPA guide the environmental review process. Implementing regulations for OCSLA (30 CFR parts 550 and 551) and NEPA (as of the April 20, 2022, revisions, 87 FR 23453) encourage orderly, safe, and environmentally responsible development of oil, natural gas, alternative energy sources, and other mineral resources on the OCS. BOEM consults with federally recognized Tribal Governments and Federal and State departments and agencies that have authority to govern and maintain ocean resources pursuant to other Federal laws. For more information on BOEM's consultation partners for specific Federal regulations and specific consultation and coordination processes with Indian Tribes, and Federal, State, and local agencies, refer to **Appendix A**. In addition, a detailed description of major Federal laws and environmental regulations that are relevant to the OCS leasing process is provided in the *Gulf of Mexico OCS Regulatory Framework* technical report, which can be found on BOEM's website (BOEM 2020a). As described above, the Inflation Reduction Act includes additional considerations for OCS oil and gas leasing by pairing the issuance of offshore wind energy leases with OCS oil and gas lease sales.

1.6 PERTINENT ENVIRONMENTAL REVIEWS AND DOCUMENTATION

BOEM used multiple environmental reviews, studies, and additional sources of information to inform the NEPA analyses throughout this Programmatic EIS. **Table 1.6-1** provides a list and brief description of these documents. Where relevant to specific analyses provided herein, these documents have been incorporated by reference.

Table 1.6-1. Description of Reference Materials Used and Incorporated by Reference (where appropriate) in the Preparation of This Programmatic EIS.

Reference Document	Summary of Information Provided
2024-2029 National Outer Continental Shelf Oil and Gas Leasing: Proposed Final Program (2024-2029 National OCS Oil and Gas Program) (OCS Study BOEM 2023-058) (BOEM 2023c)	Under Section 18 of the Outer Continental Shelf (OCS) Lands Act, the Secretary of the Interior is responsible for establishing a schedule of OCS oil and gas lease sales for a 5-year period in a National OCS Oil and Gas Leasing Program by evaluating specified attributes of OCS areas. The Proposed Final Program presents the analysis of the Proposed Program schedule of OCS oil and gas lease sales and incorporates input received during the public comment period.
2024-2029 National Outer Continental Shelf Oil and Gas Leasing Program: Final Programmatic Environmental Impact Statement (OCS EIS/EA BOEM 2023-054) (BOEM 2023b)	The Final Programmatic EIS for the 2024-2029 National OCS Oil and Gas Program focuses on high-level impacts at the national and regional scale, and describes and analyzes the potential environmental impacts that could result from leasing, exploration, production, and decommissioning associated with OCS oil and gas lease sales contemplated in the 2024-2029 National OCS Oil and Gas Program (BOEM 2023c).
Programmatic Description of the Potential Effects from Gulf of Mexico OCS Oil- and Gas-Related Activities: A Supporting Information Document (GOM Oil and Gas SID) (OCS Report BOEM 2023-053) (BOEM 2023e)	The GOM Oil and Gas SID is part of BOEM's preliminary scoping process and was developed to provide subject-matter experts, decisionmakers, and the public with a broad characterization of the Gulf of Mexico OCS; the potential activities associated with oil and gas leasing in the Gulf of Mexico OCS; other activities and environmental factors not associated with OCS oil and gas leasing; and how these various activities and factors might interact with resources in the physical, biological, and human environments. The GOM Oil and Gas SID provides the baseline information that documents the primary resources and issues analyzed in this Programmatic EIS.

Reference Document	Summary of Information Provided
Gulf of Mexico Catastrophic Spill Event Analysis: High Volume, Extended-Duration Oil Spill Resulting from Loss of Well Control on the Gulf of Mexico Outer Continental Shelf; 2nd Revision (GOM Catastrophic Spill Event Analysis) (OCS Report BOEM 2021-007) (BOEM 2021c)	This 2021 updated evaluation is a robust analysis of the impacts from low-probability catastrophic spills and is made available to all applicable decisionmakers. The analysis presented in this report is intended to be a general overview of the potential effects of a low-probability catastrophic spill in the GOM, which is not reasonably foreseeable nor a part of the proposed action but has been evaluated nonetheless in response to the Council on Environmental Quality's (CEQ's) report following the *Deepwater Horizon* explosion, oil spill, and response and is incorporated by reference herein (CEQ 2010).
Biological Environmental Background Report for the Gulf of Mexico OCS Region (Biological Environmental Background Report) (OCS Report BOEM 2021-015) (BOEM 2021b)	The Biological Environmental Background Report compiles information that describes the biological resources of the GOM region and then explores these resources' vulnerability to BOEM-regulated activities associated with the exploration and development of oil and gas, marine minerals, and renewable energy.
Gulf of Mexico OCS Regulatory Framework (OCS Report BOEM 2020-059) (BOEM 2020a)	This document describes the regulations that govern the environmental reviews for BOEM and BSEE's offshore activities involving oil, natural gas, renewable energy, and marine minerals in the GOM. It provides a framework of regulations and policies required for the OCS oil and gas leasing program.
Gulf of Mexico OCS Proposed Geological and Geophysical Activities: Western, Central, and Eastern Planning Areas – Final Programmatic Environmental Impact Statement (Gulf of Mexico G&G Final Programmatic EIS) (OCS EIS/EA BOEM 2017-051) (BOEM 2017b) and Record of Decision (ROD) (BOEM 2020b)	The Gulf of Mexico G&G Final Programmatic EIS analyzes the potential environmental impacts of performing geological and geophysical (G&G) activities on the Gulf of Mexico OCS. The ROD does not authorize any G&G activities but rather it establishes a framework for additional mandatory environmental reviews for site-specific actions and identifies applicable mitigating measures governing any future G&G activities in the region. BOEM will analyze the potential impacts of future site-specific actions in subsequent evaluations, which will tier from the Gulf of Mexico G&G Final Programmatic EIS.
Air Quality Modeling in the Gulf of Mexico Region Study (OCS Study BOEM 2019-057) (Wilson et al. 2019b)	This Air Quality Modeling Study covers topics that support BOEM's air quality management, such as developing regulatory exemption thresholds and a long-term meteorological dataset for post-lease analysis, executing modeling simulations, and assessing the potential air quality impacts of a single OCS oil and gas lease sale and the National OCS Oil and Gas Program under the NEPA framework.

Reference Document	Summary of Information Provided
Air Quality Control, Reporting, and Compliance Rule (81 FR 19718)	The final rule ensures that BOEM applies up-to-date values for the Significance Levels in 30 CFR § 550.303(e) consistent with those already established by the USEPA for analogous purposes (40 CFR § 51.165(b)(2)). This rulemaking makes other improvements to the regulations to clarify and correct inconsistencies but it would not result in any different or additional environmental impacts.

1.7 FORMAT AND ORGANIZATION OF THIS PROGRAMMATIC EIS

The remaining chapters in this Programmatic EIS are described below.

- **Chapter 2** describes the proposed action, including the potential proposed OCS oil and gas lease sale alternatives analyzed in this Programmatic EIS; summarizes the potential mitigating measures (pre- and post-lease), including the proposed stipulations; and provides a broad comparison of impacts by alternative.
- **Chapter 3** describes all of the potentially occurring actions associated with a proposed OCS oil and gas lease sale and the cumulative activities that provide a framework for detailed analyses of the potential impacts analyzed in this Programmatic EIS.
- **Chapter 4** summarizes the affected environment and the potential impacts of a proposed OCS oil and gas lease sale and each alternative by resource, focusing on any new information that may affect previous conclusions for each resource since publication of the GOM Oil and Gas SID.
- **Appendix A** describes the consultation and coordination efforts used in preparing this Programmatic EIS.
- **Appendix B** includes all of the citations referred to throughout this Programmatic EIS.
- **Appendix C** is a list of the preparers of this Programmatic EIS.
- **Appendix D** is a glossary of terms.
- **Appendix E** includes the consultation coordination letters.
- **Appendix F** includes detailed descriptions of the proposed lease stipulations.
- **Appendix G** includes descriptions of the Gulf Coast States' Coastal Management Plans.
- **Appendix H** includes BOEM's updated greenhouse gas (GHG) emissions analysis.
- **Appendix I** is a keyword index of terms used throughout this Programmatic EIS.
- **Appendix J** describes a detailed description of decommissioning activities.

CHAPTER 2

ALTERNATIVES INCLUDING THE PROPOSED ACTION

2 ALTERNATIVES INCLUDING THE PROPOSED ACTION

2.1 INTRODUCTION

The proposed action and alternatives to the proposed action evaluate holding an oil and gas lease sale on the Federal OCS in the GOM (**Chapter 1.2**). The NEPA alternatives analyzed, with the exception of the No Action Alternative, should meet the purpose and need (Section 102(C)(iii) of 42 U.S.C. § 4332; **Chapter 1.3**). This chapter presents a reasonable range of alternatives to the proposed action, including a No Action Alternative (Alternative A) and three action alternatives (Alternatives B-D). BOEM also presents the potential mitigating measures that could be used to reduce the environmental impact of the proposed action or alternatives at the lease sale stage. Finally, this chapter presents the issues and resources to be analyzed and summarizes the potential impacts by alternative. This comparison defines the issues and provides the decisionmaker and the public a clear analysis of the options.

2.2 ALTERNATIVES CONSIDERED

The discussions below describe the alternatives that are considered for this environmental analysis. All available unleased blocks within the WPA, CPA, and EPA portions of the proposed OCS oil and gas lease sale area, with the exceptions as outlined for each alternative below, are being considered for a proposed OCS oil and gas lease sale. The mitigating measures (pre- and post-lease), including the proposed stipulations, are described in **Chapter 2.2.2** of this Programmatic EIS. For a more detailed description of mitigating measures and lease stipulations, refer to **Appendix F** of this Programmatic EIS and Chapters 6 and 7 of the GOM Oil and Gas SID.

2.2.1 Alternative A – No Action

Alternative A is the cancellation of a single proposed GOM oil and gas lease sale. Under Alternative A, a proposed OCS oil and gas lease sale would not occur so there would be no new routine activities or accidental events resulting from the proposed action. Conversely, the opportunity for development of the estimated oil and gas from the proposed action would be precluded or postponed to a future proposed OCS oil and gas lease sale. Under the Inflation Reduction Act, selection of Alternative A would postpone issuance of OCS wind energy leases to a 12-month period after an OCS oil and gas lease sale offering an aggregate of 60 million acres is held. Under Alternative A, baseline conditions and ongoing activities related to previously issued leases and permits would continue. Activities that may occur in the future under existing leases or a separate proposed OCS oil and gas lease sale decision related to the Gulf of Mexico OCS Oil and Gas Program, are also included in this analysis. If a single proposed OCS oil and gas lease sale were to be cancelled, the overall level of OCS oil- and gas-related activity in the long term would only be reduced by a small percentage, if any. There would likely only be a noticeable drop in exploration and development activities as older leases reach the end of their production and new leases are not issued to replace those activities.

A cancelled proposed OCS oil and gas lease sale affects operator decisions for developing sub-economic discoveries based on the time value of money, which is the concept that a sum of money has greater value now than it will in the future due to its earning potential invested in something else.

Many deepwater discoveries are too small to warrant a dedicated development structure. Multiple smaller fields, however, can be produced by tie backs to a central hub. Decisions to place a central hub rest heavily on the expectation of continued opportunities to access OCS leases. A cancelled OCS oil and gas lease sale inhibits this flexibility, delays development decisions, and in an era of elevated interest rates, may make the cost of developing marginal fields too high such that development is deferred, sold, or cancelled altogether. When OCS oil and gas lease sales occur on a regular basis, as they generally have for many decades, operators maintain maximum flexibility in how they choose to invest in their discoveries. When an OCS oil and gas lease sale is cancelled and the uncertainty of future lease sales increases, particularly in an inflationary environment where the time value of money is a more acute factor, an operator's development decisions become more difficult to predict. If access to OCS leases is more restricted or less certain, it may present economic circumstances that increase the risk of smaller operators going bankrupt and major operators focusing their activities elsewhere in the world. In either case, the result may be lessened or fewer routine or accidental impacts from OCS oil- and gas-related activities in the GOM, but these activities and associated impacts could shift to other regions.

In summary, cancelling a proposed OCS oil and gas lease sale, resulting in a multi-year period (up to 4 years) of no new oil and gas leasing, creates two areas of uncertainty for oil and gas developers. First, operator decisions and economic outcomes become harder to predict. If operators defer or cancel investments in their discoveries because of greater economic uncertainty, then the foreseeable OCS oil- and gas-related activities become more uncertain and baseline impacts (beneficial and/or adverse) may not be realized. The current resource conditions and impacts from ongoing activities under the No Action Alternative serve as the baseline against which the direct and indirect impacts of all action alternatives are evaluated. The continuation of all other existing and reasonably foreseeable activities described in **Chapter 3.5** with the cancellation of a single proposed GOM oil and gas lease sale serves as the baseline for the evaluation of cumulative impacts in **Chapter 4**.

2.2.2 Alternative B (The Proposed Action) – Regionwide OCS Lease Sale

Alternative B (**Figure 2.2-1**) would allow for a proposed GOM oil and gas lease sale including all available unleased blocks in the WPA, CPA, and EPA Outer Continental Shelf oil and gas lease sale areas for oil and gas operations, with the following exceptions:

- whole and portions of blocks currently under Presidential withdrawal (The White House 2020);
- blocks that are adjacent to or beyond the United States' Exclusive Economic Zone (Extended Continental Shelf Area); and
- whole and partial blocks within the boundaries of the Flower Garden Banks National Marine Sanctuary as of the July 2008 Memorandum on Withdrawal of Certain Areas of U.S. OCS from Leasing Disposition (The White House 2008).

The proposed action would provide the most flexible leasing approach, including satisfying the requirements in the Inflation Reduction Act to issue renewable energy leases and provide more frequent opportunity to bid on rejected, relinquished, or expired OCS lease blocks in all three GOM planning areas. A proposed OCS oil and gas lease sale under this alternative may include proposed lease stipulations designed to reduce environmental risks. The decisionmaker will make a determination to apply stipulations discussed below in **Chapter 2.3.1** and **Appendix F** in the Record of Decision for each proposed OCS oil and gas lease sale.

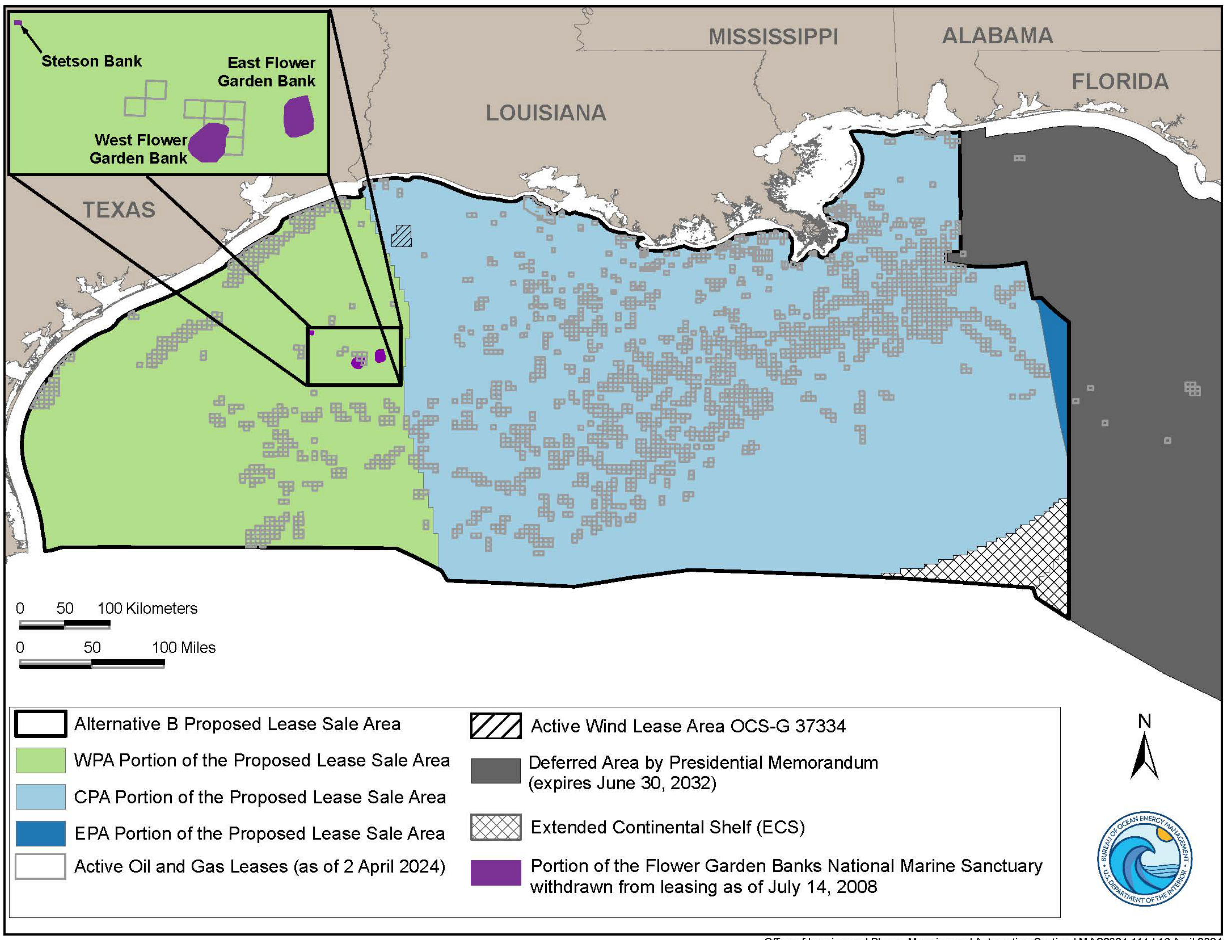

Figure 2.2-1. Proposed OCS Oil and Gas Lease Sale Area for Alternative B (a total of approximately 94.1 million acres with approximately 79.6 million acres available for lease as of April 2024).

2.2.3 Alternative C (The Preferred Alternative) – Inflation Reduction Act Targeted OCS Lease Sale Area

Alternative C (**Figure 2.2-2**) would allow for a proposed OCS oil and gas lease sale area within a reduced geographic area by excluding targeted areas from Alternative B. These exclusions were identified to focus future OCS leasing in areas of interest, for environmental considerations, to reduce marine spatial planning conflicts, and to satisfy the Inflation Reduction Act stipulations needed to issue offshore wind energy leases. The Inflation Reduction Act stipulates that, in order to issue an offshore wind energy lease, an aggregate of at least 60 million acres must be offered for offshore oil and gas leasing within the previous 12-month period. Alternative C would allow for a proposed GOM oil and gas lease sale of approximately 64.7 million acres as of May 2024, satisfying this minimum aggregate lease acreage requirement in a single OCS oil and gas lease sale. Alternative C is the agency's Preferred Alternative because it offers more than 60 million acres for leasing to satisfy the Inflation Reduction Act requirements for holding offshore wind energy sales, reduces potential marina spatial planning conflicts, and avoids areas with the most vulnerable environmental resources.

This alternative would include all available unleased blocks in the WPA, CPA, and EPA Outer Continental Shelf oil and gas lease sale areas for OCS oil- and gas-related activities, with the following exceptions:

- blocks that were excluded from consideration under Alternative B;
- whole and partial blocks subject to the proposed Topographic Features Stipulation;
- whole and partial blocks subject to the proposed Live Bottom (Pinnacle Trend) Stipulation;
- whole and partial blocks subject to the proposed Blocks South of Baldwin County, Alabama, Stipulation;
- whole and partial blocks that contain Significant Sediment Resource Areas (SSRA);
- Wind Energy Area Options (Areas A, B, C, D, E, F, G, and H) as of April 2024, final Wind Energy Areas (Areas I, J, K, L, and N), and Wind Energy Lease(s) (i.e., OCS-G 37334);
- whole and partial blocks within the Rice's whale proposed core distribution area as of April 2024; and
- whole and partial blocks within the Rice's whale proposed critical habitat area as of April 2024.

The proposed stipulations are discussed below in **Chapter 2.3.1** and **Appendix F**.

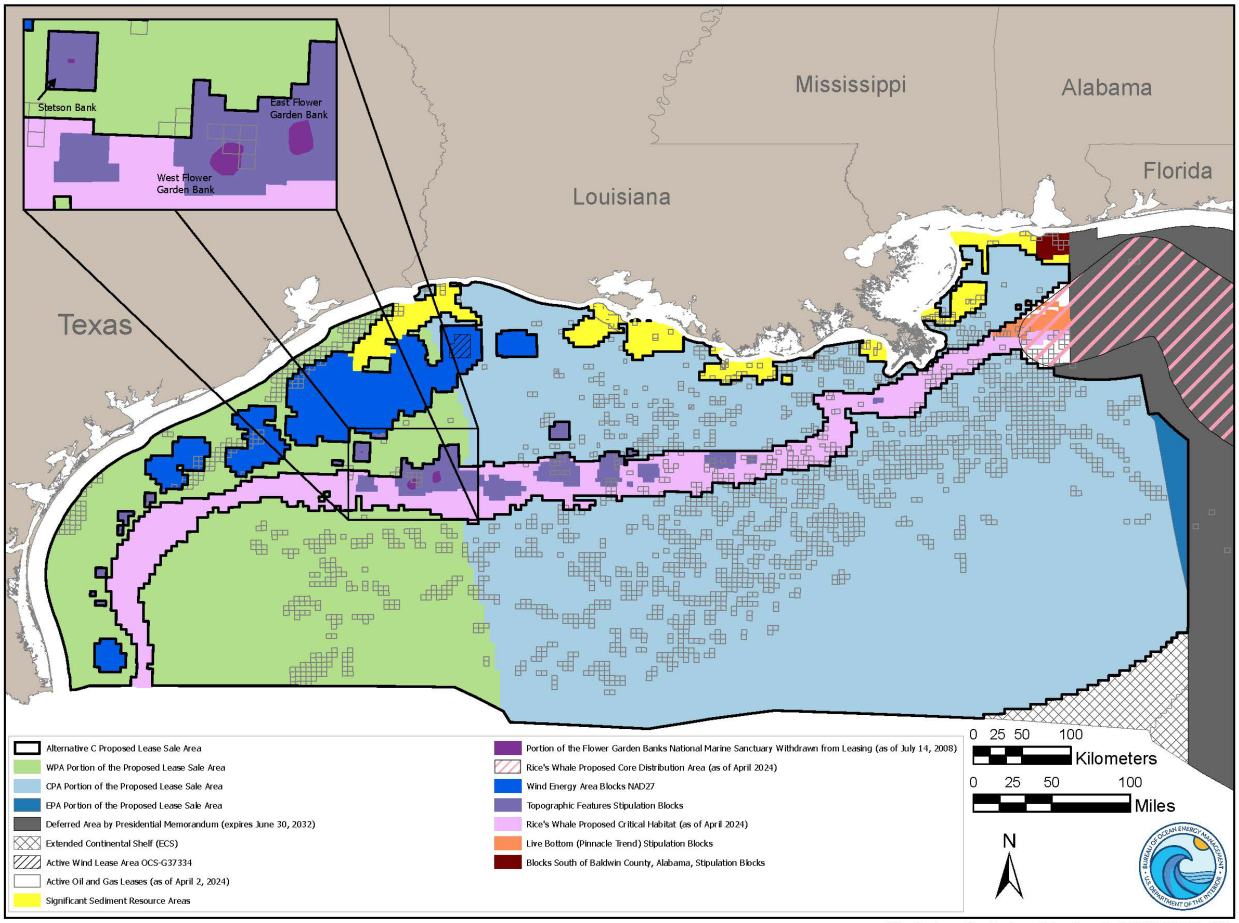

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Figure 2.2-2. Proposed OCS Oil and Gas Lease Sale Area for Alternative C (a total of approximately 75.2 million acres with approximately 64.7 million acres available for lease as of May 2024).

Unlike Alternative B, which largely relies on stipulations and mitigating measures to reduce potential environmental effects, Alternative C removes whole or partial blocks subject to the Topographic Features, Live Bottom (Pinnacle Trend), and South of Baldwin County, Alabama, Stipulations, and other sensitive areas as identified above. These areas, emphasized by public commenters in scoping for previous NEPA analyses, can be geographically defined, and have adequate existing information regarding their importance and/or ecological sensitivity to OCS oil- and gas-related activities.

2.2.4 Alternative D – Inflation Reduction Act Targeted OCS Lease Sale Area with Additional Exclusions

Alternative D (**Figure 2.2-3**) would allow for a proposed OCS oil and gas lease sale area within a smaller geographic area than Alternative C by excluding additional areas for environmental considerations and marine spatial planning. It would offer a proposed GOM oil and gas lease sale of approximately 46.1 million acres as of May 2024 and would therefore not, on its own, satisfy the aggregate lease acreage requirements of the Inflation Reduction Act to issue offshore wind energy leases. This alternative would include all available unleased blocks in the WPA and CPA OCS oil and gas lease sale areas for OCS oil and gas operations, with the following exceptions:

- blocks that were excluded from consideration under Alternative C;
- whole and partial blocks in the EPA of the GOM;
- additional whole and partial blocks of the Gulf of Mexico Wind Leasing Call Area;
- whole and partial blocks in coastal OCS waters shoreward of the 20-m (66-ft) isobath to avoid additional impacts to coastal stocks of bottlenose dolphin (*Tursiops truncatus)*;
- whole and partial blocks around the expanded Flower Garden Banks National Marine Sanctuary as of March 22, 2021; and
- whole and partial blocks identified by the Department of Defense as mission incompatibility areas.

This alternative removes whole or partial blocks from additional sensitive areas as described above because these areas have been emphasized by public commenters in scoping for previous NEPA analyses, can be geographically defined, and have adequate existing information regarding their importance and/or ecological sensitivity to OCS oil- and gas-related activities. However, this alternative further reduces the area considered in Alternative C to concentrate leasing activities into a smaller footprint to potentially further reduce the impact to the environment and to preserve additional flexibility for marine spatial planning between potential different ocean uses (i.e., OCS oil and gas development, offshore renewable energy development, marine mineral utilization, carbon sequestration, etc.).

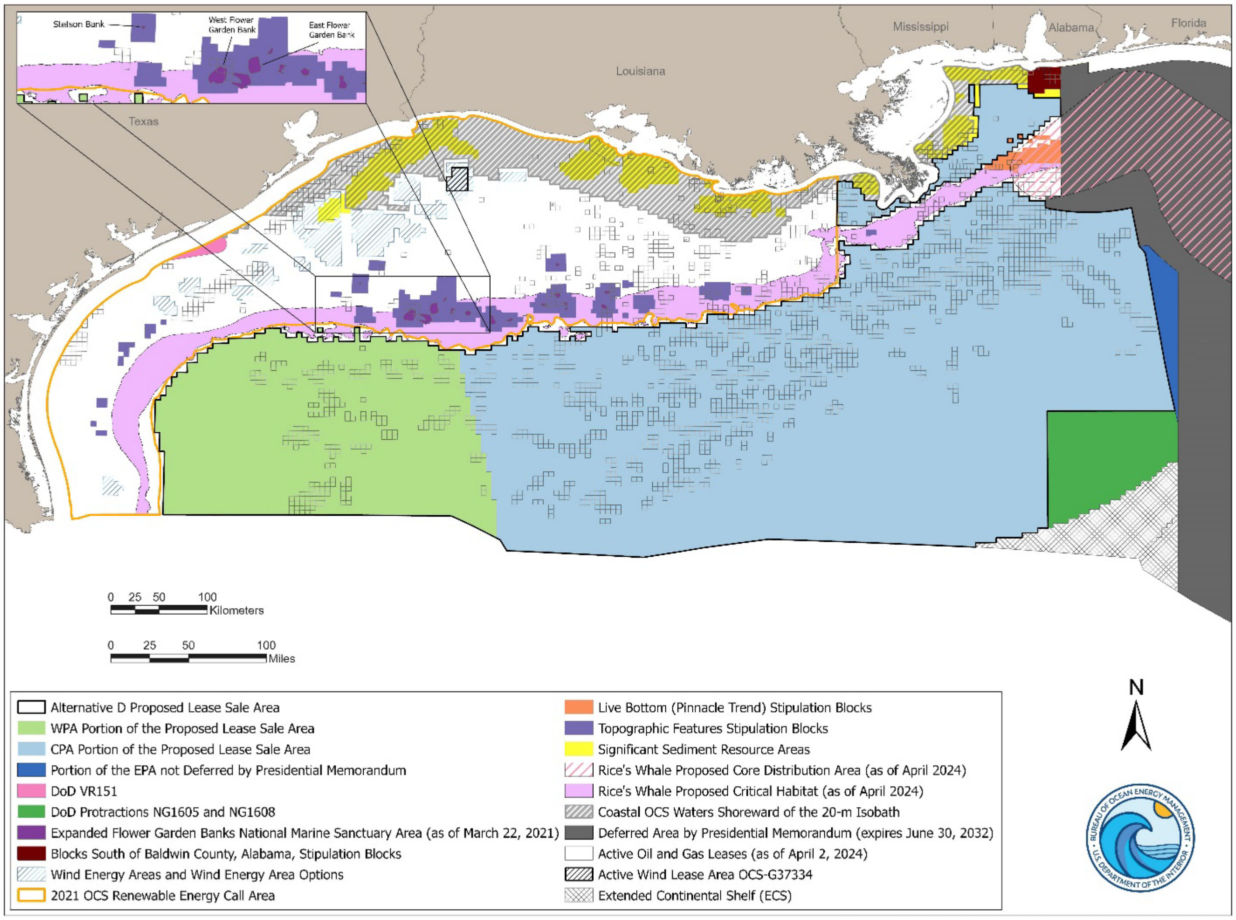

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Figure 2.2-3. Proposed OCS Oil and Gas Lease Sale Area for Alternative D (a total of approximately 54.6 million acres with approximately 46.1 million acres available for lease as of May 2024).

2.3 MITIGATING MEASURES

Mitigating measures are an integral part of the Bureau of Ocean Energy Management's OCS Oil and Gas Program to ensure that operations are conducted in an environmentally sound manner (with an emphasis on avoiding or minimizing any adverse impact of routine operations on the environment). The first-order intent of mitigation is to avoid sensitive areas, and where avoidance cannot be obtained, to reduce impacts by appropriate, targeted measures that lessen the effects of impact producing factors. BOEM considers the use of mitigation at all phases of energy development and planning. Mitigations can be applied at the prelease stage, typically through applying lease stipulations or specific G&G permit mitigations, or at the post-lease stage by applying site-specific mitigating measures to plans, permits, and/or authorizations. Through this approach, BOEM is able to analyze impacts and mitigations that are appropriate for consideration at the appropriate time. BOEM and BSEE's post-lease permitting and approval processes are described in Chapter 5 of the GOM Oil and Gas SID while Chapters 6 and 7 of the GOM Oil and Gas SID, respectively, provide a comprehensive list of commonly applied mitigating measures and potential lease stipulations.

2.3.1 Proposed Lease Stipulations

The potential lease stipulations are protective measures included for analysis in this Programmatic EIS and were developed following numerous scoping efforts for the continuing OCS Oil and Gas Program in the GOM. **Appendix F** provides a detailed description of these proposed lease stipulations. The lease stipulations being considered are as follows:

- Military Areas Stipulation;
- Evacuation Stipulation;
- Coordination Stipulation;
- Protected Species Stipulation;
- Topographic Features Stipulation;
- United Nations Convention on the Law of the Sea Royalty Payment Stipulation;
- Stipulation on the Agreement Between the United States of America and the United Mexican States Concerning Transboundary Hydrocarbon Reservoirs in the Gulf of Mexico (Transboundary Stipulation);
- Live Bottom (Pinnacle Trend) Stipulation;
- Blocks South of Baldwin County, Alabama, Stipulation;
- Restrictions due to Rights-of-Use and Easements (RUE) for Floating Production Facilities Stipulation; and
- Stipulation for Royalties on All Produced Gas.

Lease stipulations will be considered for adoption by the decisionmaker, as applicable, under authority delegated by the Secretary of the Interior. The Topographic Features and Live Bottom (Pinnacle Trend) Stipulations were applied as programmatic mitigation under the 2024-2029 National OCS Oil and Gas Program Record of Decision (BOEM 2023f); therefore, they would apply to all leases issued under the 2024-2029 National OCS Oil and Gas Program. However, because Alternatives C and D would not allow leasing in the blocks identified in the Topographic Features and Live Bottom (Pinnacle Trend) Stipulations, the adoption of these two stipulations would not result in any change to the leasing area analyzed in Alternatives C or D. The analysis of the other stipulations for any particular alternative does not ensure application of the stipulations to leases that may result from any proposed GOM oil and gas lease sale nor does it preclude minor modifications in wording during subsequent steps in the prelease process if comments indicate changes are necessary or if conditions change. Any stipulations or mitigation requirements to be included in a GOM oil and gas lease sale will be described in the Record of Decision and Final Notice of Sale for that lease sale. BSEE has the authority to monitor and enforce these conditions under 30 CFR part 250 subpart N and may seek remedies and penalties from any operator that fails to comply with those conditions, stipulations, and mitigating measures.

Table 2.3-1 indicates what stipulations could be applied for each alternative. Alternatives C and D consider the same stipulations as Alternative B, as applicable, with the exception of removing the Topographic Features, Live Bottoms (Pinnacle Trend), and Blocks South of Baldwin County, Alabama, Stipulations because all blocks subject to these stipulations would not be made available. Since Alternative A is the cancellation of a proposed OCS oil and gas lease sale, no stipulations would apply.

Table 2.3-1. Applicable Stipulations by Alternative.

Stipulation[1,2]	Alternative A[3]	Alternative B	Alternative C	Alternative D
Military Areas	–	X	X	X
Evacuation	–	X	X	X
Coordination	–	X	X	X
Protected Species	–	X	X	X
Topographic Features	–	X	–	–
United Nations Convention on the Law of the Sea Royalty Payment	–	X	X	X
Transboundary	–	X	X	X
Live Bottom (Pinnacle Trend)	–	X	–	–
Blocks South of Baldwin County, Alabama	–	X	–	–
Restrictions due to Rights-of-Use and Easements for Floating Production Facilities	–	X	X	X
Royalties on All Produced Gas	–	X	X	X

1 Stipulations that would apply to specific lease blocks under any given alternative are marked with an X.
2 Stipulations that would not apply, because the stipulation blocks or areas are not within the proposed OCS oil and gas lease sale area for that alternative, are marked "–".
3 Alternative A would cancel a proposed OCS oil and gas lease sale and any associated activities; therefore, no stipulations would apply.

2.3.2 Post-lease Conditions of Approval

Post-lease mitigating measures have been implemented for over 40 years in the Gulf of Mexico region as conditions of approval (COAs). Following a GOM oil and gas lease sale, an applicant seeks approvals to develop their lease by preparing and submitting OCS plans. The OCS plans and permit applications are reviewed by BOEM and, depending on what is proposed to take place on a specific lease, right-of-way, or right-of-use, may be denied, approved, or approved with COAs. The COAs become part of the approved post-lease authorization or permit approval and include environmental protection requirements that maintain conformance with law, the requirements of other agencies having jurisdiction, or safety precautions. Over time, BOEM realized that many of these site-specific mitigations were recurring and developed a list of commonly applied "standard" mitigations. Some BOEM-identified mitigating measures are incorporated into OCS oil- and gas-related operations through cooperative agreements or efforts with industry and State and Federal agencies. Operational compliance of the mitigating measures is enforced through BSEE's office and field compliance verification and inspection program. BOEM and BSEE, working together, are continually revising applicable mitigations to more easily and routinely track their effectiveness and compliance with them.

Chapter 5 of the GOM Oil and Gas SID discusses BOEM and BSEE's rigorous post-lease processes and Chapter 6 of the GOM Oil and Gas SID describes over 120 standard mitigations that may be required by BOEM or BSEE as a result of plan and permit review processes for the Gulf of Mexico OCS region. Compliance with all regulatory requirements, including post-lease COAs and their mitigating effects, is considered part of the proposed action.

2.4 PRIMARY TOPICS AND RESOURCES EVALUATED

For the purposes of this Programmatic EIS, issues are defined as those principal "effects" that an EIS should evaluate in-depth. As part of the scoping process, the lead agency shall determine the scope and the significant issues to be analyzed in depth in the EIS (40 CFR § 1501.9(e)) as of April 2024). The analysis in this Programmatic EIS can then show the degree of change from the present conditions to the conditions from the actions arising from the proposed action for each issue.

2.4.1 Issues to be Analyzed

The GOM Oil and Gas SID, which is incorporated by reference, provides an introduction to the issues related to potential impact-producing factors and the environmental and socioeconomic resources and activities that could be affected by OCS oil- and gas-related activities. Chapter 4 of the GOM Oil and Gas SID describes the resources and activities that could be affected by the impact-producing factors described in Chapter 2 of the GOM Oil and Gas SID. **Chapter 3** of this Programmatic EIS identifies several issues or impact-producing factors related to routine activities, accidental events, or cumulative activities to be evaluated (**Table 2.4-1**).

Table 2.4-1. Impact-Producing Factors Related to Routine Activities, Accidental Events, or Cumulative Activities.

Routine Activities	Accidental Events	Cumulative Activities
Air Emissions and Pollution	Unintended Releases into the Environment	Air Emissions and Pollution
Discharges and Wastes	Response Activities	Discharges and Wastes
Bottom Disturbance	Strikes and Collisions	Bottom Disturbance
Noise	-	Noise
Coastal Land Use/Modification	-	Coastal Land Use/Modification
Lighting and Visual Impacts	-	Lighting and Visual Impacts
Offshore Habitat Modification/Space Use	-	Offshore Habitat Modification/ Space Use
Socioeconomic Changes and Drivers	-	Socioeconomic Changes and Drivers
-	-	Climate Change
-	-	Natural Processes
-	-	Other Cumulative Factors

In addition to the above-mentioned IPFs, BOEM identified greenhouse gas emissions and space-use issues as issues of programmatic concern, which are described in more detail in **Chapter 4.0.2**. **Chapter 4** of this Programmatic EIS describes the environmental and socioeconomic resources and activities that could be affected by the IPFs and issue of programmatic concern identified above and described in **Chapters 3 and 4.0.2**, and includes the resource categories shown in **Table 2.4-2**.

Table 2.4-2. GOM Oil and Gas Programmatic EIS Resource Categories.

Air Quality	Sea Turtles
Water Quality	Commercial Fisheries
Coastal Communities and Habitats	Recreational Fishing
Benthic Communities and Habitats	Recreational Resources
Pelagic Communities and Habitats	Cultural, Historical, and Archaeological Resources
Fishes and Invertebrates	Land Use and Coastal Infrastructure
Birds	Economic Factors
Marine Mammals	Social Factors (including Environmental Justice)

Comments received during scoping raised additional issues for consideration in this Programmatic EIS. Several comments related to the NEPA process, Inflation Reduction Act, this NEPA analysis generally, alternatives, exclusion areas, and mitigating measures were incorporated or considered in the preparation of applicable parts of this Programmatic EIS. Other issues analyzed in detail in the environmental analysis are shown in **Table 2.4-3**.

Table 2.4-3. Scoping Issues Identified for Detailed Environmental Analysis.

Climate Change	Commercial Fisheries
Greenhouse Gases	Recreational Resources
Alternative Use	Economic Factors
Air Quality	Social Factors
Water Quality	Other Resources
Benthic Communities and Habitats	Consultations
Fishes and Invertebrates	Cumulative Analysis
Marine Mammals	Oil Spills
Sea Turtles	-

Scoping comments are summarized in **Appendix A** of this Programmatic EIS and detailed in the GOM Oil and Gas Scoping Report, which can be found on BOEM's website at https://www.boem.gov/environment/environmental-assessment/gulf-mexico-regional-ocs-oil-and-gas-programmatic. Issues raised during scoping are analyzed in detail in their respective resource analyses in **Chapter 4**. Analysis for life-cycle greenhouse gas emissions is published in **Appendix H** and summarized in **Chapter 4.0.2.1**.

2.4.2 Issues Considered but Not Analyzed

As part of the scoping process, agencies shall identify and eliminate from detailed study the issues that are not significant to the proposed action or have been covered by prior environmental review (40 CFR § 1501.9(f)). Several comments received during scoping were outside the scope of this analysis and therefore not analyzed in detail. Topics not analyzed in detail include the 2024-2029 National OCS Oil and Gas Program, bid requirements, oil rights, and changes to regulations. The temporally static or transient aspects of the physical setting such as the GOM's geology, oceanography, and meteorology are not analyzed, except when they interact with IPFs having relevance to environmental or socioeconomic resources.

2.5 COMPARISON OF IMPACTS BY ALTERNATIVE

The full analyses of the potential impacts of routine activities and accidental events associated with an OCS oil and gas lease sale and its incremental contribution to the cumulative impacts are described in detail in the individual resource discussions in **Chapter 4**. **Table 2.5-1** presents the environmental impacts of the Proposed Action and the Alternatives in comparative form based on the information and analysis presented in **Chapter 4**. Each resource includes a range of impact levels to account for certain variables such as uncertainty in the level and magnitude of potential accidental events, and the minimization of the OCS oil- or gas-related impacts through lease stipulations, post-lease mitigations, and/or other regulatory requirements. It must also be emphasized that, in arriving at the overall conclusions for certain environmental resources, the conclusions are not based on impacts to individuals, small groups of animals, or small areas of habitat, but on impacts to the resources/populations as a whole. This Programmatic EIS uses a four-level classification scheme to characterize the potential beneficial impacts and adverse impacts of alternatives as either negligible, minor, moderate, or major. The impact-level ratings are defined generally for each resource in **Tables 4.0-2 and 4.0-3** and, where required, resource-specific, expanded definitions are provided in the resource analysis. Impact conclusions for individual IPFs and cumulative activities expected – whether a proposed OCS oil and gas lease sale were to occur or not – are in the individual resource analyses in **Chapter 4**.

Table 2.5-1. Comparison of Overall Impacts by Alternative for Each Resource Category.

Resource	Alternative A	Alternative B	Alternative C	Alternative D
Air Quality[1]	Direct and indirect impacts would be **none**.	**Negligible** to **moderate negative** from routine air emissions and pollutants and accidental events, though air quality should recover quickly with or without remediation.	Impacts to regional air quality would likely be similar as Alternative B (ranging from **negligible** to **moderate negative**) because Alternative C would still make substantial areas in shallow waters available for leasing and overall activity levels are the same. However, reduced leasing in water depths <200 m (656 ft) could potentially decrease venting activities and associated methane emissions.	Impacts to regional air quality would likely be similar as Alternative B (ranging from **negligible** to **moderate negative**) because Alternative D would still make substantial areas in shallow waters available for leasing and overall activity levels are the same. However, reduced leasing in water depths <200 m (656 ft) could potentially decrease venting activities and associated methane emissions.
Water Quality	Direct and indirect impacts would be **none**.	Routine activities would have negligible effects due to existing regulatory requirements. Accidental events, depending on magnitude and severity, could have **minor** to **moderate adverse** impacts. Trends and OSRA analyses show that most spills (>95%) are 1 bbl or less, and small spills (<1,000 bbl) would weather and disperse quickly.	**Negligible** to **moderate adverse** impacts to regional water quality, similar to Alternative B. In the areas excluded from leasing, impacts to water quality would be reduced to **negligible** for all IPFs.	**Negligible** to **moderate adverse** impacts to regional water quality, similar to Alternative B. In the areas excluded from leasing, impacts to water quality would be reduced to **negligible** for all IPFs.

Resource	Alternative A	Alternative B	Alternative C	Alternative D
Coastal Communities and Habitats	Direct and indirect impacts would be **none**.	**Negligible** to **moderate adverse** impacts, primarily associated with the slight risk of large spills and associated response activities affecting coastal communities and habitats. However, trends and OSRA analyses show that most spills (>95%) are 1 bbl or less, and small spills (<1,000 bbl) would likely weather and disperse before reaching coastal communities and habitats.	**Negligible** to **moderate adverse** impacts, similar to Alternative B, with decreased potential for oil spills and response activities to affect coastal habitats adjacent to the exclusion areas, including substantial areas along Texas and Louisiana, and all areas along the Mississippi and Alabama coast.	**Negligible** to **moderate adverse** impacts, similar to Alternatives B and C, with further decreased potential for oil spills and response activities to affect coastal habitats adjacent to the exclusion areas, including all areas along the Texas, Mississippi, and Alabama coast, and most areas along the Louisiana coast.
Benthic Communities and Habitats	Direct and indirect impacts would be **none**.	Implementation of the proposed action could result in **negligible** to **major adverse** impacts on benthic communities and habitats, including protected corals. With the application of BOEM's protective measures (i.e., avoidance, distancing, and shunting requirements), the impacts would be **negligible** to **minor adverse**.	With the application of BOEM protective measures (i.e., avoidance, distancing, and shunting requirements), the impacts would be **negligible** to **minor adverse**, similar to Alternative B. Routine impacts to benthic habitats, including protected corals, in the excluded areas would be **none**.	With the application of BOEM's protective measures (i.e., avoidance, distancing, and shunting requirements), the impacts would be **negligible** to **minor adverse**, similar to Alternative B. Routine impacts to benthic habitats, including protected corals, in the excluded areas would be **none**.
Pelagic Communities and Habitats	Direct and indirect impacts would be **none**.	Overall impacts would be **negligible** to **minor adverse** because of the localized nature of the effects compared to the basin-wide distribution of plankton and *Sargassum* in the northern GOM.	**Negligible** to **minor adverse** similar to Alternative B. Routine impacts to pelagic communities and habitats in the excluded areas would be **none**, but impacts from some IPFs (e.g., vessel strikes and oil spills) could still occur in the excluded areas. Alternative C would not change the overall impact conclusions for pelagic communities and habitats given their wide distribution across the GOM.	**Negligible** to **minor adverse** similar to Alternative B. Routine impacts to pelagic communities and habitats in the excluded areas would be **none**, but impacts from some IPFs (e.g., vessel strikes and oil spills) could still occur in the excluded areas. Alternative D would not change the overall impact conclusions for pelagic communities and habitats given their wide distribution across the GOM.

Resource	Alternative A	Alternative B	Alternative C	Alternative D
Fish and Invertebrates	Direct and indirect impacts would be **none**.	Implementation of the proposed action could result in **negligible** to **moderate adverse** impacts on fish and invertebrate resources; however, with the application of BOEM's protective measures (i.e., avoidance, and distancing requirements), the impacts would be reduced to **minor adverse**.	**Negligible** to **minor adverse** similar to Alternative B. However, Alternative C would provide greater protection than Alternative B for highly productive and diverse fish and invertebrate assemblages, including recreationally and commercially managed finfish species, known to inhabit hard bottom habitats like topographic and pinnacle trend features found in the areas excluded from leasing.	**Negligible** to **minor adverse** similar to Alternatives C but may further reduce impacts specific to coastal and estuarine fishes and invertebrates due to additional exclusion areas in nearshore waters.
Birds	Direct and indirect impacts would be **none**.	Impacts from routine activities and most accidental events would likely be **negligible** to **minor adverse**; however, larger oil spill(s) could have up to **moderate adverse** impacts depending on their frequency, duration, geographic extent, and mitigation effectiveness.	**Negligible** to **moderate adverse** similar to Alternative B. Alternative C would not directly or indirectly influence the impact conclusions for birds, including ESA-listed species, because of their abundance and basin-wide distribution across the northern GOM.	**Negligible** to **moderate adverse** similar to Alternatives B and C. Alternative D would not directly or indirectly influence the impact conclusions for birds, including ESA-listed species, because of their abundance and basin-wide distribution across the northern GOM.

Resource	Alternative A	Alternative B	Alternative C	Alternative D
Marine Mammals	Direct and indirect impacts would be **none**.	Without protective measures, impacts from harmful levels of noise; entanglement, entrapment, or ingestion; accidental vessel strikes; accidental oil-spill contact; and spill-response activities could increase to **major adverse**. Impacts would be **negligible** to **moderate adverse**[2] with the implementation of protective measures.	Similar to Alternative B, **negligible** to **major adverse** without protective measures, reduced to **moderate adverse**[2] with proposed mitigating measures and applicable regulatory requirements. Alternative C would not change the overall impact conclusions for marine mammals given their wide distribution across the GOM, transitory use of the excluded areas, and because impacts from some IPFs (e.g., vessel strikes and oil spills) could still occur in the excluded areas.	Similar to Alternative B, **negligible** to **major adverse** without protective measures, reduced to **moderate adverse**[2] with proposed mitigating measures and applicable regulatory requirements. Alternative D would not change the overall impact conclusions for marine mammals given their wide distribution across the GOM, transitory use of the excluded areas, and because impacts from some IPFs (e.g., vessel strikes and oil spills) could still occur in the excluded areas.
Sea Turtles	Direct and indirect impacts would be **none**.	Without protective measures, impacts from harmful levels of noise; entanglement, entrapment, or ingestion; accidental vessel strikes; accidental oil-spill contact; and spill-response activities could increase to **moderate adverse**. Impacts would be **negligible** to **minor adverse** with the implementation of protective measures.	Similar to Alternative B, **negligible** to **moderate adverse** without protective measures, reduced to **minor adverse** with proposed mitigating measures and applicable regulatory requirements. Alternative C would not change the overall impact conclusions for sea turtles given their wide distribution across the GOM, transitory use of the excluded areas, and because impacts from some IPFs (e.g., vessel strikes and oil spills) could still occur in the excluded areas.	Similar to Alternative B, **negligible** to **moderate adverse** without protective measures, reduced to **minor adverse** with proposed mitigating measures and applicable regulatory requirements. Alternative D would not change the overall impact conclusions for sea turtles given their wide distribution across the GOM, transitory use of the excluded areas, and because impacts from some IPFs (e.g., vessel strikes and oil spills) could still occur in the excluded areas.

Resource	Alternative A	Alternative B	Alternative C	Alternative D
Commercial Fisheries	Direct impacts from the proposed action would be avoided, including any potential beneficial effects from structure emplacement. Indirect effects, if any, from energy substitution due to canceling a single proposed OCS oil and gas lease sale would likely be **negligible**.	**Negligible** to **minor adverse** impacts on commercial fisheries depending on the locations of activities, species affected, intensity of commercial fishing activity in the affected area, and substitutability of any lost fishing access. **Negligible** to **minor beneficial** impacts from artificial reef effects of new OCS infrastructure.	**Negligible** to **minor adverse** and beneficial impacts similar to Alternative B because overall scenario ranges would remain the same and because there would still be a substantive overlap of available acreage and highly used commercial fishing areas from a regional perspective. However, Alternative C could reduce localized space-use conflicts and potential impacts to commercial fisheries from noise, bottom disturbance, habitat loss, and oil spills in the areas excluded from leasing.	Adverse and beneficial impacts from routine activities would more than likely be reduced to **negligible** considering the vast overlap of most commercial fishing areas and the areas excluded from leasing. However, because large oil spills could still potentially travel into the excluded areas under certain conditions, the potential impacts from accidental events would still range from **negligible** to **minor adverse**.
Recreational Fishing	Direct impacts from the proposed action would be avoided, including any beneficial artificial reef effects from structure emplacement. Any indirect effects because of the precluded leasing and associated activities from a single proposed OCS oil and gas lease sale would be **negligible**.	**Negligible** to **minor adverse** impacts on recreational fishing depending on the locations of activities, species affected, and intensity of commercial fishing activity in the affected area, and substitutability of any lost fishing access. **Negligible** to **minor beneficial** impacts from artificial reef effects of new OCS infrastructure.	**Negligible** to **minor adverse** and **beneficial** impacts similar to Alternative B because overall scenario ranges would remain the same and because there would still be a substantive overlap of available leasing acreage and common recreational fishing areas from a regional perspective. However, Alternative C could reduce the probability of some accidental events being experienced in common recreational fishing areas off the Texas and western Louisiana coast.	**Negligible** to **minor adverse** and **beneficial** impacts overall, similar to Alternative C, but further reduced off Texas and western Louisiana because of the vast overlap of most recreational fishing areas and the areas excluded from leasing.

Resource	Alternative A	Alternative B	Alternative C	Alternative D
Recreational Resources	Direct impacts from the proposed action would be avoided, including any potential beneficial effects from structure emplacement. Indirect effects, if any, from energy substitution due to canceling a single proposed OCS oil and gas lease sale would likely be **negligible**.	Ranging from **minor beneficial** to **minor adverse** impacts depending on the proximity of activities to recreational resources and the type of recreational use. For example, new infrastructure could improve recreational diving opportunities (i.e., beneficial impact), whereas a large oil spill could reduce beach access and/or visitation.	Ranging from **minor beneficial** to **minor adverse** similar to Alternative B, although the spatial constraints could reduce the probability of some accidental events being experienced in adjacent recreational areas, especially in Texas and western Louisiana.	Potential impacts would be reduced to **negligible** because the majority of recreational use areas near the coastline would be excluded and notably distanced from the available lease areas.
Cultural, Historical, and Archaeological Resources[3]	Direct and indirect impacts would be **none**. However, cancellation of a single proposed OCS oil and gas lease sale would be an incremental reduction in the discovery and knowledge of potential archaeological resources in unleased blocks.	**Negligible** to **minor negative** with the application of survey and mitigation requirements at the post-lease stage. However, where protective measures cannot be applied or adhered to and an accidental event comes into direct physical contact with an archaeological resource, negative impacts to that resource could be **negligible** to **major**.	Ranging from **negligible** to **minor negative** similar to Alternative B. Impacts to archaeological resources within the areas excluded from leasing would be reduced to **negligible** or **none**.	Ranging from **negligible** to **minor negative** similar to Alternative B. Impacts to archaeological resources within the areas excluded from leasing would be reduced to **negligible** or **none**.
Land Use and Coastal Infrastructure	Direct and indirect impacts would be **none**. Cancellation of a single proposed OCS oil and gas lease sale would not be expected to cause any noticeable changes in coastal land use patterns given the expansive existing OCS oil- and gas-related infrastructure and the reasonably foreseeable lease sales.	Overall impacts would be **minor adverse**. New or expanded coastal infrastructure as a result of the proposed action is not likely given the expansive existing OCS oil- and gas-related infrastructure.	Impacts to land use and coastal infrastructure are tied directly to the level of offshore activities, and a lease sale under Alternative C is not expected to alter the forecasted development activity. Therefore, overall impacts would be **minor adverse**, similar to Alternative B.	Impacts to land use and coastal infrastructure are tied directly to the level of offshore activities, and a lease sale under Alternative D is not expected to alter the forecasted development activity. Therefore, overall impacts would be **minor adverse**, similar to Alternative B.

Resource	Alternative A	Alternative B	Alternative C	Alternative D
Economic Factors	**Minor** to **moderate adverse** impacts assuming some degree of substitution by other energy sources, and that future OCS oil and gas lease sales remain reasonably foreseeable at least for the next 10 years.	Ranging from **minor** to **moderate beneficial** impacts from routine activities by sustaining or improving economics and employment in most sectors. Accidental events could have **minor** to **moderate adverse** impacts to fisheries, tourism, or other sectors depending on their magnitude and extent and effectiveness of associated mitigation and response activities. When considering all IPFs together, however, the generally short-term and localized nature or effects of accidental events are somewhat outweighed by the economic benefits from routine activities, resulting in **minor** to **moderate beneficial** overall impacts under Alternative B.	From a regional perspective, Alternative C still leaves substantial areas available for leasing across all water depths, and overall production and activity levels are not expected to significantly differ from Alternative B. Therefore, overall impacts would be similar to Alternative B, ranging from **minor** to **moderate beneficial**.	From a regional perspective, overall impacts would be similar to Alternative B, ranging from **minor** to **moderate beneficial** because overall production and activity levels are not expected to significantly differ from Alternative B. However, a shift to deeper waters could have a disproportionate adverse impact on some operators that rely heavily on shallow-water operations, as most acreage in water depths <200 m (656 ft) would not be offered under Alternative D.
Social Factors	Direct and indirect impacts would be **negligible**. Cancellation of a single proposed OCS oil and gas lease sale would not be expected to result in a notable adverse impact to regional employment or other social factors.	Routine activities could lead to **minor** beneficial to **negligible adverse** impacts because of the existing extensive and widespread support system for the petroleum industry and its associated labor force. Accidental events could have **minor beneficial** to **moderate adverse** impacts if remedial or mitigating measures are necessary before the affected community can return to prior conditions.	**Minor** beneficial to **negligible adverse** for routine activities and **moderate adverse** for accidental events, similar to Alternative B. However, removal of the wind energy areas, SSRAs, and other blocks could reduce the probability of some accidental events being experienced in adjacent coastal areas, especially in Texas and western Louisiana	**Minor beneficial** to **negligible adverse** for routine activities and **moderate adverse** for accidental events, similar to Alternative B. However, removal of the wind energy areas, SSRAs, and other blocks could reduce the probability of some accidental events being experienced in adjacent coastal areas, especially in Texas and western Louisiana

[1] The term "adverse" has a specific meaning under the Clean Air Act. Therefore, to avoid confusion in the air quality analysis, the term "negative" is used in the identification of impacts under NEPA and should not be interpreted as synonymous with "adverse" impacts as defined under the Clean Air Act.

[2] In the unlikely event of a strike on an ESA-listed whale, the determination could be up to major.

[3] The term “adverse” has a specific meaning under the National Historic Preservation Act (NHPA). Therefore, to avoid confusion in the cultural, historical, and archaeological resources analysis, the term “negative” is used in the identification of impacts under NEPA and should not be interpretated as synonymous with “adverse” impacts as defined under the NHPA.

CHAPTER 3

ACTIVITIES, SCENARIOS, AND IMPACT-PRODUCING FACTORS

3 ACTIVITIES, SCENARIOS, AND IMPACT-PRODUCING FACTORS

3.1 INTRODUCTION

This chapter describes offshore oil- and gas-related activities and the scenarios developed to analyze and project the range of future routine, accidental, and cumulative activities, as well as impact-producing factors (IPFs) associated with a representative proposed oil and gas lease sale in the Gulf of Mexico under any of the action alternatives. **Chapter 3.2** describes activities that occur during oil and gas development resulting from a single representative proposed GOM oil and gas lease sale. Three distinct scenarios (ongoing, single OCS oil and gas lease sale, and cumulative) are presented in **Chapter 3.3** to forecast the range of activities that could occur within a proposed OCS oil and gas lease sale area, and to group these activities within the context of their associated IPFs. **Chapter 3.4** describes the IPFs that may result from routine OCS oil and gas development activities. **Chapter 3.5** describes accidental events which have the potential to occur throughout the lifetime of a lease. Finally, **Chapter 3.6** describes cumulative activities from both the Cumulative OCS Oil and Gas Program scenario and non-OCS oil- and gas-related activities in the GOM that could potentially affect biological, physical, and socioeconomic resources. Refer to Chapters 1.3.3 and 2 of the GOM Oil and Gas SID for additional detailed descriptions of these activities and IPFs. As described below, this information is incorporated by reference.

What is a Scenario?

A scenario provides an estimate of the level of offshore activity that could result from a proposed action. **Figure 3.1-1** depicts the location on the Gulf of Mexico OCS of the offshore subareas or water-depth ranges. The water-depth ranges were developed to reflect the technological requirements, related physical and economic impacts as a consequence of the oil and gas potential, exploration and development activities, and lease terms unique to each water-depth range. **Chapter 3.3.2** explains the relationship between the ongoing, single OCS oil and gas lease sale, and cumulative scenarios and the range of alternatives considered in this Programmatic EIS. The proposed action scenarios and activity levels were developed based on the following factors:

How are ranges determined?
The low and high OCS oil and gas production scenarios, and the factors that influence them, are used to create the range in anticipated oil and gas activity.

- recent trends in the amount and location of OCS seismic survey vessel activity, leasing, exploration, development, and decommissioning activity;
- historical oil and gas prices, price trends, oil and gas supply and demand, and related factors that influence oil and gas product-price and price volatility;
- estimates of undiscovered, unleased, conventionally recoverable OCS oil and gas resources;
- existing offshore and onshore oil and/or gas infrastructure and resource availability (e.g., drilling rig availability);

- industry information; and
- oil- and gas-related technologies, and the economic considerations and environmental constraints of these technologies.

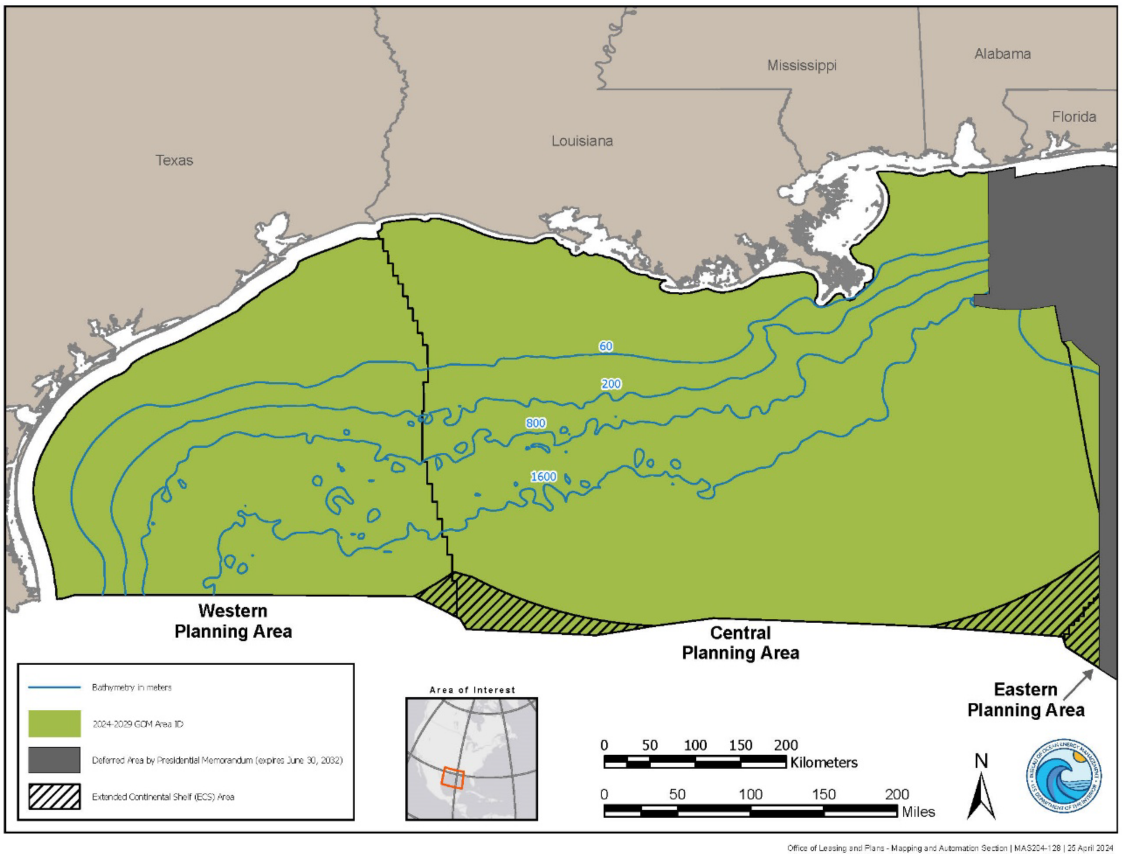

Figure 3.1-1. Offshore Subareas in the Gulf of Mexico.

The analyses are compared with actual historical activity and infrastructure data to ensure that historical precedent, as well as recent trends, are reflected in each activity forecast. Due to the inherent uncertainties associated with an assessment of undiscovered resources, the scenarios are reported as a range of values corresponding to probabilities of occurrence. Scenario ranges provide flexibility to characterize the full range of potential impacts that could occur under each of the proposed action alternatives.

What is an Impact-Producing Factor?

An IPF is the outcome or result of any proposed or ongoing OCS oil- and gas-related activities with the potential to affect (positively or negatively) physical, biological, cultural, and/or socioeconomic resources. These IPFs are grouped into "issue" categories based on BOEM's internal and external scoping and consideration of the extensive history of public input received through previous and ongoing assessments and outreach efforts. Both OCS and non-OCS oil- and gas-related activities can contribute to one or multiple IPF categories.

How are the Impact-Producing Factors Categorized?

Routine OCS Oil- and Gas-Related Activities. These are routine operations that generally occur during the lifetime of a lease. The activities are broken down by phase and include exploration, development, oil or gas production and transport, and decommissioning as discussed below in **Chapter 3.4** of this Programmatic EIS and Chapter 1.3.3 of the GOM Oil and Gas SID. These descriptions are applicable to activities resulting from the proposed action (i.e., a single representative proposed OCS oil and gas lease sale), as well as activities resulting from existing and future GOM oil and gas leases.

Accidental OCS Oil- and Gas-Related Events. Types of accidental events include releases into the environment (e.g., oil spills, loss of well control, accidental air emissions, pipeline failures, chemical and drilling fluid spills, and trash and debris), response activities, and collisions or vessel strikes (e.g., vessel to vessel and vessel striking a marine resource). Reasonably foreseeable accidental events associated with OCS oil and gas development are discussed below in **Chapter 3.5** of this Programmatic EIS and in Chapter 2.9 of the GOM Oil and Gas SID.

Cumulative Activities. Past, present, and reasonably foreseeable activities occurring within the same time or place and could result in cumulative impacts. The Cumulative OCS Oil and Gas Program scenario includes all activities (i.e., routine OCS oil- and gas-related activities and accidental events, as described above) from past, proposed, and future GOM oil and gas lease sales (**Chapter 3.6.1**). The ongoing OCS oil and gas scenario in **Table 3.3-2** includes present and future activities only resulting from past GOM oil and gas lease sales as ongoing activities. Non-OCS oil- and gas-related past, present, and reasonably foreseeable cumulative activities are those considered independent of OCS oil and gas leasing and are reasonably expected regardless of whether OCS oil and gas leasing and associated activities occur. These other related impact-producing factors or activities are described below in **Chapter 3.6.2** and within each IPF category under the subheading "Non-OCS Oil- and Gas-Related Activities" in Chapter 2 of the GOM Oil and Gas SID.

3.2 Phases of OCS Oil and Gas Development Resulting from a GOM Oil and Gas Lease Sale

The OCS oil- and gas-related operations resulting from a single GOM oil and gas lease sale generally occur in five phases: (1) remote sensing of subsurface formations and structures with seismic surveying; (2) exploration to locate viable oil or natural gas deposits; (3) development well drilling, platform construction, and pipeline infrastructure; (4) operation (oil or gas production and transport); and (5) decommissioning of facilities once a reservoir is no longer productive or profitable (**Figure 3.2-1**). These activities are briefly described below with additional information provided in Chapter 1.3.3 of the GOM Oil and Gas SID and a description of the post-lease permitting and approval process in Chapter 5 of the GOM Oil and Gas SID. As described in **Chapter 3.2.1**, geological and geophysical (G&G) surveys may occur before leasing takes place and are included in **Table 3.3-3**. The estimated level of activity associated with each phase of development is also provided in **Chapter 3.3.**

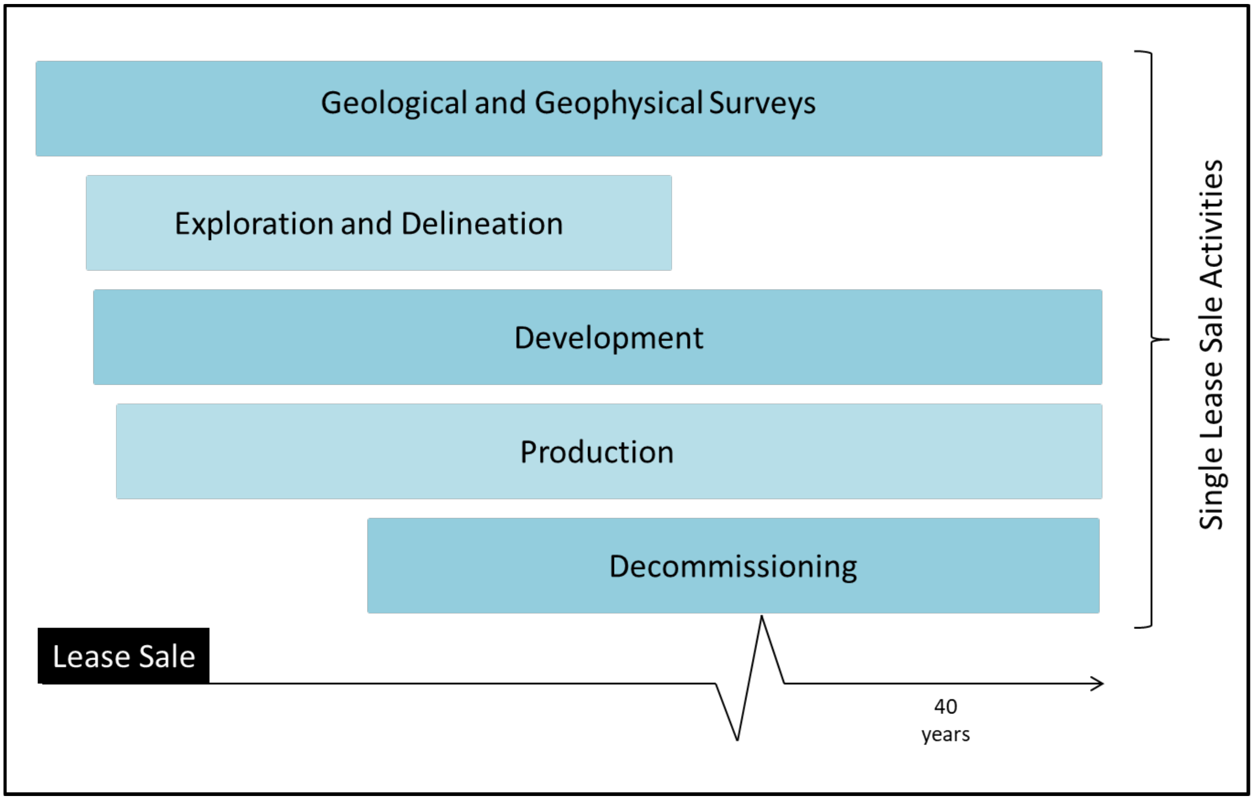

Figure 3.2-1. Phases of OCS Oil and Gas Activity Resulting from a Single Proposed GOM Oil and Gas Lease Sale over 40 Years.

Activities would occur on OCS leases only after a proposed OCS oil and gas lease sale is held. Forecasts indicate that the significant activities associated with exploration, development, production, and abandonment of leases in the GOM occur within the 40-year analysis period of a single proposed OCS oil and gas lease sale, although unusual cases exist where activity on a lease may continue beyond 50 years. For example, subsea activity may take place on a lease without additional platforms being built. In these instances, a subsea well may be drilled on a lease acquired during the proposed OCS oil and gas lease sale but tied back to an existing platform from a previous OCS oil and gas lease sale. This could potentially increase the lifespan of platforms from older OCS oil and gas lease sales.

Across all phases of development, offshore service vessels are one of the primary modes of transporting personnel and supplies between service bases and offshore platforms, drilling rigs, derrick barges, and pipeline construction barges. In addition to personnel, service vessels carry cargo offshore (i.e., freshwater, fuel, cement, barite, liquid and recycled drilling fluids, tubulars, equipment, and food). Service vessels were evaluated for the following categories: wells (exploration and development drilling); well workovers; plug and abandonment of wells; platform installation; platform operation; platform decommissioning; subsea installation; subsea removal; and pipeline installation. Other offshore vessel operations, including geological sampling and seismic surveying activity associated with a leasing event, is assumed to be covered in the estimates provided in **Table 3.3-2**.

Helicopters are the only aircraft used for transporting personnel between service bases and offshore platforms, drilling rigs, derrick barges, and pipeline construction barges. Helicopters are routinely used for normal crew changes and at other times (such as emergencies) to transport management and special service personnel to offshore exploration and production sites. In addition, equipment and supplies are sometimes transported. An operation is considered a roundtrip and includes takeoff and landing.

3.2.1 Geological and Geophysical Surveys

A variety of G&G surveys are conducted in support of OCS oil- and gas-related activities to (1) determine if there is industry interest for oil and gas leasing in the area, (2) obtain data for exploration and production, (3) aid in siting offshore infrastructure (e.g., production platform or pipeline routes), (4) identify possible seafloor or shallow depth geologic hazards, and (5) locate potential archaeological resources and potential hard bottom habitats for avoidance. The G&G activities for oil and gas exploration may occur either before leasing takes place (prelease; assessing interest) or after authorization of an existing lease (post-lease; project-related ancillary activities; such as vertical seismic profiling, a method used to calibrate seismic data with well log data). The types of G&G surveys conducted for oil and gas exploration and development are summarized in **Table 3.2-1**. More detail on each survey type can be found in Chapter 1.3.3 of the GOM Oil and Gas SID and Appendix F of the *Gulf of Mexico OCS Proposed Geological and Geophysical Activities: Western, Central, and Eastern Planning Areas; Final Programmatic Environmental Impact Statement* (BOEM 2017b).

The scenario evaluated in this Programmatic EIS includes ancillary activities, as defined in 30 CFR § 550.105[1]. Other non-ancillary, post-lease G&G activities resulting from a single proposed GOM oil and gas lease sale are subject to additional BOEM review and approval. Post-lease activities (ancillary or other) conducted by operators can include additional seismic surveys, non-airgun high-resolution geophysical (HRG) seismic surveys, and seafloor sampling, including via stratigraphic wells, shallow test wells, and geotechnical sampling. BOEM oversees G&G data acquisition and permitting activities pursuant to regulations at 30 CFR parts 550 and 551. Post-lease activities can occur on an existing lease authorized by OCS plan approvals, plan revisions, or by a required notification to BOEM before certain ancillary activities are undertaken. Guidance for each type of ancillary activity, the type and level of BOEM review, follow-up actions, and post-survey report requirements are provided in NTL No. 2009-G34. If BOEM determines that the type of proposed ancillary activity necessitates revising an existing OCS plan, a NEPA review is triggered. In addition

[1] 30 CFR § 550.105 defines ancillary activities as "those activities on your lease or unit that you: (1) Conduct to obtain data and information to ensure proper exploration or development of your lease or unit; and (2) Can conduct without BOEM approval of an application or permit." You means a lessee, the owner or holder of operating rights, a designated operator or agent of the lessee(s), a pipeline right-of-way holder, or a State lessee granted a right-of-use and easement.

to the NEPA review, the operator must have an approved exploration plan, development and production plan (documentation form applying to all OCS planning areas, except the CPA and WPA of the GOM), or development operations coordination document, each of which would be subject to a NEPA review as part of initial plan approval.

Table 3.2-1. Geological and Geophysical Survey Types.

Category and Purpose(s)	Survey Type
Deep-Penetration Seismic Surveys – Most, if not all, deep-penetration seismic surveys use airguns. Seismic surveys evaluate subsurface geological formations to assess potential hydrocarbon reservoirs and optimally site exploration and development wells. The 2D surveys provide a cross sectional image of the Earth's structure while 3D provides a volumetric image of underlying geological structures. Repeated 3D surveys result in time lapse, or 4D, surveys that assess the depletion of a reservoir. Borehole seismic surveys provide information about geologic structure, lithology, and fluids.	2D Seismic Surveys 3D Seismic Surveys Ocean-Bottom 2D Seismic Surveys (cable or nodes) Ocean-Bottom 3D Seismic Surveys (cable or nodes) Wide-Azimuth and Related Multi-Vessel Surveys 3D Coil Surveys (source vessel uses circular sailing pattern instead of a rectilinear pattern) Borehole Seismic Surveys (2D and 3D VSP surveys and SWD) Vertical Cable Surveys 4D Time-Lapse Surveys
Airgun High-Resolution Geophysical (HRG) Surveys – A single, small airgun used to assess shallow hazards, benthic habitats, bottom-founded structure emplacement.	High-Resolution Seismic Surveys[A]
Non-Airgun Acoustic High-Resolution Geophysical (HRG) Surveys – Assess shallow hazards, potential sand and gravel resources and dredging borrow pit design for coastal restoration, archaeological resources, and benthic habitats. The HRG surveys are run with a suite of tools, indicated at right, during the same deployment.	Subbottom Profiling Surveys[AB] Side-Scan Sonars[AB] Single-Beam and Multibeam Echosounders[AB] Magnetometers
Non-Acoustic Marine Geophysical Surveys – Electromagnetic signals are used to develop a conductivity/ resistivity profile of the seafloor, helping to identify economic hydrocarbon accumulations and aid with archaeological surveys.	Marine Gravity Surveys Marine Magnetic Surveys Marine Magnetotelluric Surveys Marine Controlled Source Electromagnetic (CSEM) Surveys

Category and Purpose(s)	Survey Type
Airborne Remote Surveys – Gravity and magnetic surveys are used to assess structure and sedimentary properties of subsurface horizons. Airborne magnetic surveys evaluate deep crustal structure, salt-related structure, and intra-sedimentary anomalies.	Airborne Gravity Surveys Airborne Magnetic Surveys
Geological and Geotechnical Surveys – Collect bottom water samples, surface and near-surface sediment samples to assess seafloor properties for siting structures such as platforms, pipelines, or cables. Geologic coring is also used to assess sediment characteristics for use in coastal restoration projects. Shallow test drilling is conducted to place test equipment into a borehole to evaluate gas hydrates or other properties. The deeper COST wells evaluate stratigraphy and hydrocarbon potential without drilling directly into oil- and gas bearing strata.	Grab and Box Sampling[AB] Geologic Coring[AB] Shallow Test Drilling[A] COST Wells[A] Cone Penetrometer Tests[A]
Other Surveys and Equipment – The devices in this category assist in the execution of surveys, either by providing location or facilitating underwater service tasks. Additionally, water guns are no longer used as a seismic source except in extremely rare instances.	Acoustic Pingers (including Pressure Inverted Echo Sounders [PIES])[A] Wave Gliders Transponders, Transceivers, Responders[A] ROVs and AUVs[A]

2D = two-dimensional; 3D = three-dimensional; 4D = four-dimensional; AUV = autonomous underwater vehicle; COST = continental offshore stratigraphic test; HRG = high-resolution geophysical; ROV = remotely operated vehicle; SWD = seismic while drilling; VSP = vertical seismic profile.

[A] Survey type also applicable to BOEM Renewable Energy Program Activities.

[B] Survey type also applicable to BOEM Marine Minerals Program Activities.

3.2.2 Exploration and Delineation

Exploration for OCS oil and gas is the process of searching for and characterizing hydrocarbon resources. The exploration stage involves G&G surveys (including seismic surveys, HRG surveys, controlled source electromagnetic surveys, and gravity and magnetic surveys), sediment sampling, and exploratory drilling. The most reliable way to determine whether the identified formations or structures contain hydrocarbons is to drill into them; however, the decision to drill is not taken solely on geological grounds. Government requirements, economic factors (drilling costs, transport costs, market conditions, relative merit/financial risk), and technical feasibility (including safety and environmental considerations) are all factored into the decision. Following an OCS oil and gas lease sale, exploratory drilling activity would likely occur early during a lease term (determined by water depth), but could begin within 1 year.

If a resource is discovered during the drilling of an exploration well in quantities appearing to be economically viable, one or more follow-up “delineation” or “appraisal” wells are drilled to determine the size and the extent of the field. In the GOM, exploration and delineation wells are typically drilled from mobile offshore drilling units (MODUs). The MODUs are self-contained with their own power generation, static (anchored) or dynamic positioning system, utilities, and living quarters. Supplies are brought to the rig and wastes are returned to shore by supply boat; crews are transferred on and off the rig by helicopters and/or service vessels. These types of service vessels (including supply boats) are included in the scenario estimates for service vessel trips. Once the rig is fixed in position, drilling of the well begins. Drilling operations are typically conducted around-the-clock, generally over 1-3 months, depending on the depth of the hydrocarbon formation and the geological conditions as described in Chapter 1.3.3.2 of the GOM Oil and Gas SID.

3.2.3 Development

Development drilling differs from exploratory drilling in that the hydrocarbon resource has been identified and delineated. The objective is to target formations or structures as efficiently as possible so as to not drill more wells than is necessary to produce the reservoir. Should an operator decide to move forward with producing a well, completion operations must be undertaken. The type of well completion used to prepare a well for production is based on the rock properties of the reservoir as well as the properties of the reservoir fluid. However, for the vast majority of well completions, the typical process includes installing or “running” the production casing; cementing the casing; perforating the casing and surrounding cement; injecting water, brine, or gelled brine as carrier fluid for a “frac pack” (sand, ceramic beads, or other proppant); treating/acidizing the reservoir formation near the wellbore; installing production screens; running production tubing; and installing a production tree. Most development well drilling would likely occur in the first 25 years of each OCS lease.

3.2.4 Production

Production of OCS oil and gas on a lease could begin as early as 3 years after an OCS oil and gas lease sale. There is a range of offshore infrastructure installed for hydrocarbon production, including pipelines, bottom-fixed and floating platforms, caissons, well protectors, casing, wellheads, flowlines and risers, manifolds, jumpers, flowline support sleds, subsea systems, and conductors. **Figures 3.2-2 and 3.2-3** illustrate the types of fixed and MODU production facilities used at various water depths. More information on each structure is presented in Chapter 1.3.3.4 of the GOM Oil and Gas SID. Platform installations occurring in earlier years of a lease would most likely be caissons and small fixed platforms in shallow water. Floating structures installed in deeper water would take several years to construct and install and tend to take first production later in the life cycle of a lease.

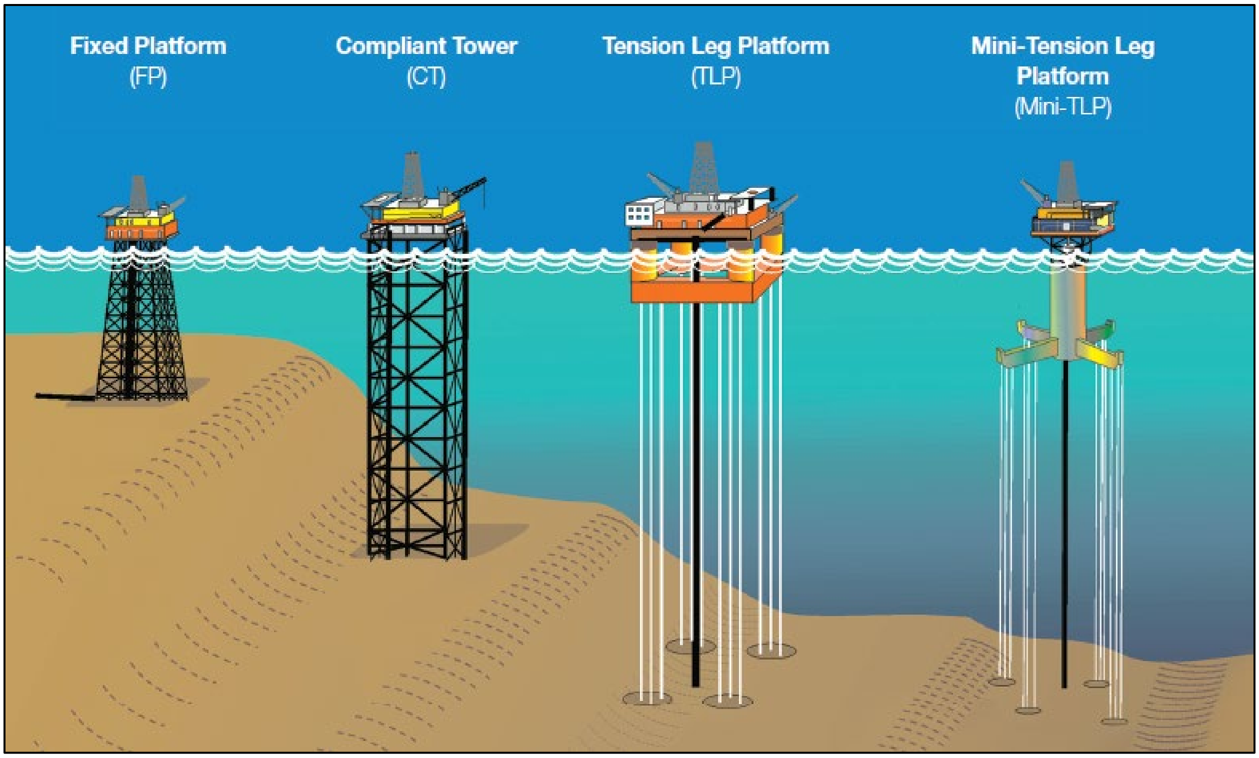

Figure 3.2-2. Offshore Production Facilities Commonly Used in Shallow to Moderately Deep Waters.

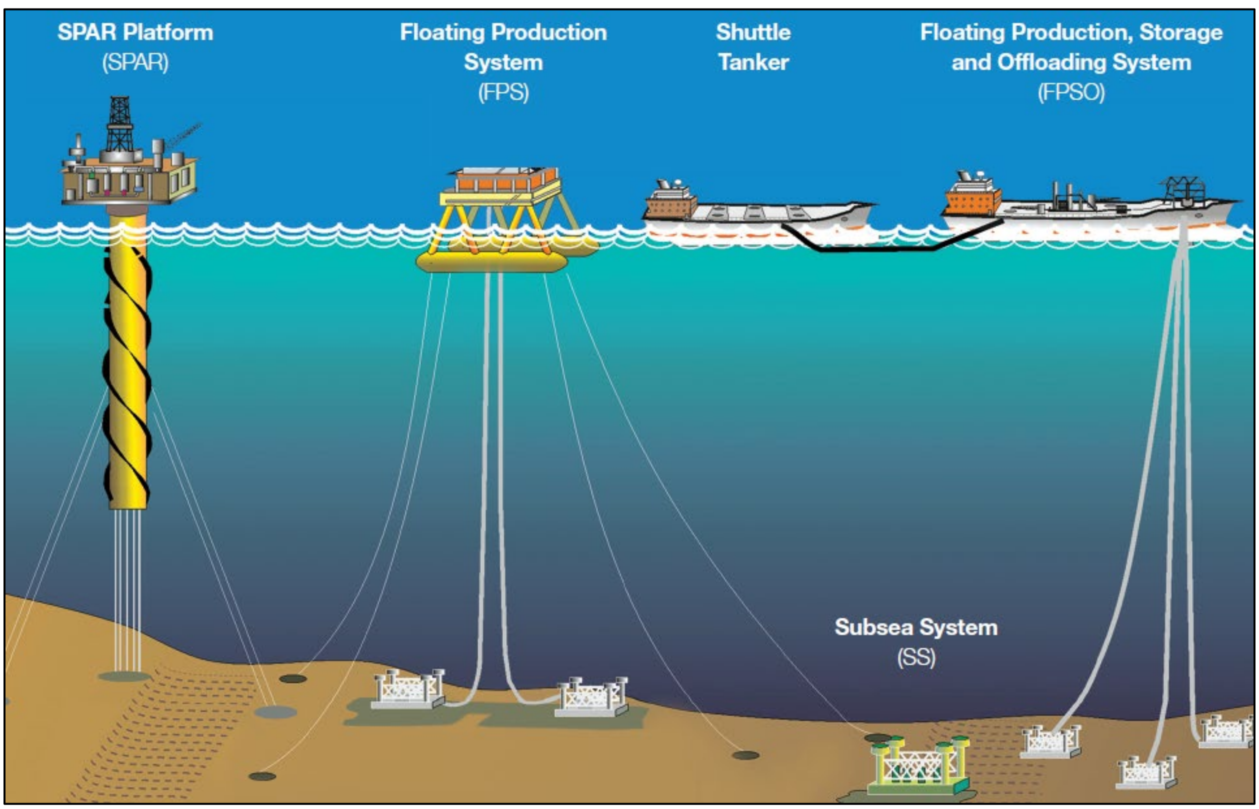

Figure 3.2-3. Offshore Production Facilities More Commonly Used in Deep to Ultra-deep Waters.

An expansive pipeline network is the primary method used to transport a variety of liquid and gaseous products between OCS production sites and onshore facilities around the GOM (refer to Chapter 1.3.3.4 of the GOM Oil and Gas SID). BOEM projects that the majority of new pipelines constructed as a result of a proposed action would connect to the existing pipeline infrastructure offshore or in State waters. BOEM projects that 0-1 new pipeline landfalls could result from a proposed GOM oil and gas lease sale; however, a new landfall has not been permitted since 2014. Historically, barging in the GOM has accounted for less than 1 percent of the oil transported for the entire OCS Oil and Gas Program, and it is assumed that this trend will continue overall and for any single proposed GOM oil and gas lease sale. Shuttle tankers are used to transport crude oil from floating production, storage, and offloading (FPSO) systems to Gulf Coast refinery ports or to offshore deepwater ports such as the Louisiana Offshore Oil Port. The FPSOs are only projected to occur in water depths greater than 1,600 m (5,250 ft). Oil from an FPSO is expected to be 100 percent tankered while oil from another type of floating platform is expected to be 100 percent piped. Refer to Chapter 2.9.3.3 of the GOM Oil and Gas SID for more information on vessel traffic.

Completed and producing offshore wells may require periodic reentry that is designed to maintain or restore a desired flow rate. These procedures are referred to as a well “workover.” Workover operations are also carried out to evaluate or reevaluate a geologic formation or reservoir (including recompletion to another stratum) or to permanently abandon a part or all of a well. Workovers on subsea completions require that a rig be moved on location to provide surface support. Workovers can take from 1 day to several months to complete depending on the complexity of the operations, with a median of 7 days. Based on historical data, BOEM projects that a producing well may have seven workovers or other well activities during its active lifetime (typically every 3-5 years).

3.2.5 Decommissioning

Decommissioning activities apply to wells, structures, and other appurtenances (e.g., pipelines), as described below. Structures are generally grouped into two main categories depending upon their relationship to the platform/facilities (i.e., piles, jackets, caissons, templates, mooring devises, etc.) or the well (i.e., wellheads, casings, casing stubs, etc.).

In compliance with Section 22 of BOEM’s Oil and Gas Lease Form (BOEM-2005) and BSEE regulations (30 CFR § 250.1710—Wellheads/Casings and 30 CFR § 250.1725—Platforms and Other Facilities), operators need to remove seafloor obstructions from their leases within 1 year of lease termination or after a structure has been deemed obsolete or unusable. Further, Federal regulations require that offshore leases be cleared of all structures within 1 year after production on the lease ceases, but a producing lease can hold infrastructure idle for as long as the lease is producing (30 CFR § 250.112). While production structures are removed, appurtenances or types of equipment (e.g., subsea infrastructure systems, pipelines, umbilical lines, etc.) are typically allowed by BSEE to remain on the seafloor (i.e., decommissioned in place), as allowed under certain conditions in 30 CFR part 250 and which typically includes additional NEPA review by BOEM (refer to Chapter 5 of the GOM Oil and Gas SID).

A varied assortment of severing devices and methodologies has been designed to cut structural targets during decommissioning activities. These devices are generally grouped and classified as either nonexplosive or explosive, and they can be deployed and operated by divers, remotely operated vehicles, or from the surface. Which severing tool the operators and contractors use takes into consideration the target size and type, water depth, economics, environmental concerns, tool availability, and weather conditions. Nonexplosive severing tools are used on the OCS for a wide array of structure and well decommissioning targets in all water depths. Many decommissions use both explosive and nonexplosive technologies (prearranged or as a backup method). Explosive severance tools can be deployed on almost all structural and well targets in all water depths. Between 2004 and 2022, 56 percent of platform removals used explosives as a severing method during the decommissioning process (Welsch, official communication, 2023). Based on 10-year historical trends (2013-2022), about 65 percent of future platform removal permit applications are anticipated to continue to request authorization for the use of explosive severing methods, often as a back-up cutter when other nonexplosive methodologies prove unsuccessful (Welsch, official communication, 2023).

There are two types of well abandonment operations—temporary and permanent—that can occur at any of the phases of a well. An operator may temporarily abandon or “suspend” a well to (1) allow detailed analyses or additional delineation wells while deciding if a discovery is economically viable, (2) save the wellbore for a future sidetrack to a new geologic bottom-hole location, or (3) wait on design or construction of special production equipment or facilities. Before abandonment, non-producing wells are sometimes converted into water injection wells to drive further hydrocarbon production (secondary recovery), dispose of wastewater, enhance oil production and mining, or prevent saltwater intrusion. Carbon dioxide can be used for tertiary well recovery (termed enhanced oil recovery). This practice has never been used on the OCS but it is a common procedure onshore. Permanent abandonment operations are undertaken when a wellbore is of no further use to the operator (i.e., the well is a dry hole or the well’s producible hydrocarbon resources have been depleted). During permanent abandonment, equipment is removed from the well, and cement plugs are set at specific intervals in the wellbore to isolate the reservoir and formations. A cement surface plug is also required for the abandoned well. The cement surface plug serves as the final isolation component between the wellbore and the environment.

While production offshore structures are generally removed, it is anticipated that offshore pipelines and multiple appurtenances or types of offshore equipment (e.g., subsea infrastructure systems: pipeline end modules, subsea tie-ins, pipeline end terminals, manifolds, jumpers, umbilical lines, etc.) would not be removed from the seafloor if they do not constitute a hazard (obstruction) to navigation and commercial fishing operations, unduly interfere with other uses of the OCS such as sand resources, or have adverse environmental effects, as allowed under certain conditions in 30 CFR § 250.1750. At the end of its useful life, or because of a catastrophic event such as a hurricane, an offshore pipeline may be decommissioned in place, which normally involves cleaning the line by pigging (procedure to clear residual hydrocarbon) and flushing or flushing alone (with approval by BSEE’s Regional Field Operations Regional Supervisor), cutting the pipeline endpoints, and then plugging and burying each endpoint below the seabed or covering the endpoints with a concrete mattress. Conventionally, a platform pipeline is typically cut near the base of the platform by divers or remotely operated vehicle and a cap is installed on the end. The end of the pipeline that remains on the seafloor is plugged and buried 3 ft (1 m) below the seabed. The onshore pipeline may be removed completely, or some sections may be abandoned in place due to their transition through a sensitive environment. The pipeline end seaward of the surf zone is capped and jetted down 3 ft (1 m) below the mudline by divers. The recovery of decommissioned and removed pipeline sections could be accomplished by rigging a winch wire to the pipeline and lifting it to the barge, but excavation may be required to remove the pipeline. Processes for infrastructure removal are discussed in greater detail in Chapter 2.3.1.3 of the GOM Oil and Gas SID. BSEE may not approve abandonment in place for pipelines installed in areas of the GOM determined to have near-surface sand or mixed sediments that could be valuable for flood control or coastal restoration. To make the sediment available for these purposes, BSEE may require the pipeline operator to excavate and remove a pipeline to avoid interfering with dredging operations.

Decommissioning Trends

Installation and decommissioning trends in the GOM reflect geologic prospectivity and production trends. At the beginning of offshore development, installations normally far exceeded decommissioning activity; however, as a region matures and fields deplete, decommissioning begins to dominate and active structure inventory declines. New discoveries may still be made in the region but the contribution of new structures relative to decommissioning activity would be negligible. Research by Kaiser and Narra (2018a) suggests that decommissioning activity fluctuates year-to-year, and from 2007 through 2017 between 100 and 290 structures were decommissioned annually in water depths less than 400 ft (122 m). This level of decommissioning activity in water depths less than 400 ft (122 m) is the result of the aging infrastructure, maturity of producing properties in the region, sustained low oil and gas prices, and regulatory conditions and oversight. From 1989 to 2017, a total of 23 structures in water depths greater than 400 ft (122 m) have been decommissioned (Kaiser and Narra 2018a). This is due to several factors but the most obvious are the small number of structures installed annually, as well as the significant capital expenditures and planning required in development and execution. Decommissioning activities in water depths greater than 400 ft (122 m) are expected in the years ahead unless alternative uses for structures are found. From 2009 to 2019, roughly 11,500 mi (18,507 km) of pipeline was decommissioned; approximately 98 percent of which was abandoned in place in accordance with the requirements at 30 CFR § 250.1006, while the other 2 percent was removed.

Forecasted platform removals by water-depth range for ongoing, single OCS oil and gas lease sale, and cumulative OCS Oil and Gas Program scenarios are shown in **Table 3.3-2**. Of the 2,394-2,853 production structures estimated to be removed from the GOM in the Cumulative OCS Oil and Gas Program scenario, 940-1,022 production structures (installed landward of the 800-m [2,625-ft] isobath) would likely be removed using explosives. It is anticipated that most offshore pipelines and appurtenances (e.g., subsea systems, pipeline end modules, subsea tie-in, manifolds, jumpers, pipeline end terminals, umbilical lines, etc.) would be decommissioned in place on the seafloor if they do not constitute a hazard (obstruction) to navigation and commercial fishing operations, unduly interfere with other uses of the OCS, or have adverse environmental effects, as allowed under certain conditions in 30 CFR § 250.1750.

3.3 Overview of Activities, Scenario, and Impact-Producing Factors

3.3.1 Timetables and Production Estimates

Offshore oil and gas leases range in duration depending on hydrocarbon production on the lease; however, BOEM projects that the overwhelming majority of the oil and natural gas fields discovered in the GOM as a result of a single representative OCS oil and gas lease sale would reach the end of its economic life within a time span of 40 years following a proposed OCS oil and gas lease sale based on historic activity trends analyzed in the scenario. Exploration and development activity forecasts become increasingly uncertain as the length of time of the forecast increases due to an increasing number of influencing factors, and unusual cases may exist where activity on a lease may continue beyond 40 years. Therefore, the activities associated with exploration, development, production, and decommissioning of leases in the GOM (**Chapter 3.2**) have been assumed to occur within a 40-year analysis period (2024-2063).

The Cumulative OCS Oil and Gas Program scenario was developed with an analysis period of 70 years or 2024-2093, which encompasses the 40-year analysis period for a single proposed OCS oil and gas lease sale, as well as the analysis period for activities associated with reasonably foreseeable future proposed OCS oil and gas lease sales. Recent development trends show that almost all activities from a single proposed OCS oil and gas lease sale occur within a 40-year period, with some extending up to 50 years. Therefore, BOEM used a 40-year analysis period for the single lease sale scenario but, since some could extend up to 50 years, BOEM conservatively used a 70-year time period for the cumulative scenario. It is important to note that a single proposed OCS oil and gas lease sale, no matter which alternative is selected, would represent only a small portion of activity and a small incremental contribution (0.3-1.8%) to the overall Cumulative OCS Oil and Gas Program activity forecasted to occur in the GOM between 2024 and 2093. Further information about the Cumulative OCS Oil and Gas Program scenario can be found in **Chapter 3.6.1**.

Table 3.3-1 presents the ranges of projected offshore oil and gas production for ongoing oil and gas production anticipated from existing GOM leases, a single representative proposed OCS oil and gas lease sale (2024-2063), and for the Cumulative OCS Oil and Gas Program (2024-2093).

Table 3.3-1. Range of Projected Oil and Gas Production Resulting from Leasing Activity in the Gulf of Mexico OCS.

Reserve/Resource Production	Ongoing (2024-2063)	Single OCS Oil and Gas Lease Sale (2024-2063)	OCS Cumulative (2024-2093)
Oil (BBO)	5.819-12.308	0.055-0.756	14.042-24.469
Gas (Tcf)	6.71-15.559	0.077-0.997	16.224-33.751

BBO = billion barrels of oil; Tcf = trillion cubic feet.

Note: The OCS cumulative includes projected production from ongoing, single OCS oil and gas lease sale and future OCS oil and gas lease sales.

The majority of oil and gas resources in the Gulf of Mexico are located within the boundaries of all the action alternatives (B-D). Relatively more exploration and development drilling would occur in deepwater (depths >200 m [660 ft]), regardless of the activity level scenario. Over the entire 40-year scenario for a typical lease production would not be equally distributed across water-depth categories and would have geographic specificity based on geology. To demonstrate that the forecasted production occurs throughout the 40 years and is not consolidated into a narrow timeframe, i.e., a single year, the highest total Gulfwide production in any given year would be 0.052 billion barrels of oil equivalent (BBOE), and the highest total Gulfwide production in any given 5-year span would be 0.246 BBOE (averaging 0.049 BBOE per year when producing).

3.3.2 Expected Activity Scenario

Three distinct scenarios are presented in this Programmatic EIS to forecast the range of potential activities that could occur within a proposed OCS oil and gas lease sale area. Ongoing activities include all current and future activities related to previously issued leases and permits through GOM oil and gas Lease Sale 261. This ongoing scenario is applicable to all alternatives considered, including Alternative A (no action), because the present and future activities only resulting from past GOM oil and gas lease sales as ongoing activities would occur regardless of the alternative selected and are considered part of the existing baseline. Single Sale Activities include those that would result from a representative proposed OCS oil and gas lease sale under a National OCS Oil and Gas Program, regardless of which action alternative (i.e., Alternative B, C, or D) is selected. The ranges within this Single Sale scenario are broad, representing the low and high levels of forecasted activity. While the selection of one representative proposed OCS oil and gas lease sale alternative over another could shift the location of the forecasted activities, the overall range of activity levels would not change under Alternative B, C, or D. Finally, activities in the cumulative scenario include the activities described under the ongoing and single OCS oil and gas lease sale activities, as well as activities anticipated to result from actions carried out on OCS acreage leased in future National OCS Oil and Gas Programs (refer to **Chapter 3.6.1**).

The routine OCS oil- and gas-related activities associated with exploration, development, production, and decommissioning from ongoing and future proposed OCS oil and gas lease sales are shown in **Table 3.3-2**. Projected activity levels are shown as a range and distributed into subareas based on water depth as shown in **Figure 3.1-1**. These water-depth ranges were developed to reflect the technological requirements, related physical and economic impacts from the oil and gas potential, exploration and development activities, and lease terms unique to each water-depth range. The activities included in **Table 3.3-2** are estimated to occur within the 40-year analysis period of 2024-2063 for a single proposed OCS oil and gas lease sale; this assumption applies to ongoing as well because it does not include future lease activity. The cumulative scenario assumes continued GOM leasing; therefore, it analyzes activity over a 70-year (2024-2093) period.

Table 3.3-2. Offshore Scenario Activities by Water Depth.

Activity	Action	0-60 m	60-200 m	200-800 m	800-1,600 m	>1,600 m	Total Lease Sale Area[1]
Exploration and Delineation Wells	Ongoing	0-78	0-76	0-57	0-161	0-163	0-535
Exploration and Delineation Wells	Single OCS Oil and Gas Lease Sale	0-32	0-35	3-9	3-23	3-27	9-126
Exploration and Delineation Wells	Cumulative	49-325	29-155	38-479	272-689	261-687	649-2,335
Development and Production Wells[2,3]	Ongoing Oil and Gas Combined[3]	0-359	0-116	0-151	0-232	0-248	0-1,106
Development and Production Wells[2,3]	Single OCS Oil and Gas Lease Sale Combined	0-26	0-29	2-10	3-28	2-31	7-124
Development and Production Wells[2,3]	Cumulative Oil & Gas Combined	263-900	237-658	148-648	323-685	319-728	1,290-3,619
Development and Production Wells[2]	Ongoing Oil	0-185	0-81	0-115	0-192	0-215	0-788
Development and Production Wells[2]	Single Oil	0-4	0-4	1-8	2-24	1-26	4-66
Development and Production Wells[2]	Cumulative Oil	156-495	176-369	119-519	269-541	276-637	996-2,561
Development and Production Wells[2]	Ongoing Gas	0-173	0-34	0-35	0-39	0-32	0-313
Development and Production Wells[2]	Single Gas	0-21	0-24	0-1	0-3	0-4	0-53
Development and Production Wells[2]	Cumulative Gas	106-404	60-288	28-128	53-143	42-90	289-1,053
Installed Production Structures	Ongoing	0-44	0-7	0-3	0-4	0-4	0-62
Installed Production Structures	Single OCS Oil and Gas Lease Sale	0-26	0-29	0-1	0-2	0-2	0-60
Installed Production Structures	Cumulative	27-136	17-44	3-14	7-14	6-14	60-222
Subsea Structures Installed[4]	Ongoing	0	0	0-38	0-55	0-58	0-151
Subsea Structures Installed[4]	Single OCS Oil and Gas Lease Sale	0	0	1-3	1-7	1-8	3-18
Subsea Structures Installed[4]	Cumulative	0	0	41-178	81-172	80-182	202-532

Activity	Action	0-60 m	60-200 m	200-800 m	800-1,600 m	>1,600 m	Total Lease Sale Area[1]
Production Structures Removed Using Explosives	Ongoing	729-757	182-187	0	0	0	911-944
Production Structures Removed Using Explosives	Single OCS Oil and Gas Lease Sale	0-17	0-19	0	0	0	0-36
Production Structures Removed Using Explosives	Cumulative	747-814	193-208	0	0	0	940-1,022
Total Production Structures Removed	Ongoing	1,121-1,165	280-287	119-160	319-378	294-356	2,133-2,346
Total Production Structures Removed	Single OCS Oil and Gas Lease Sale	0-26	0-29	1-4	1-9	1-11	3-79
Total Production Structures Removed	Cumulative	1,149-1,252	297-320	163-304	407-498	378-479	2,394-2,853
Length of Installed Pipelines (km)[5]	Ongoing	0-89	0-35	0-94	0-431	0-551	0-1,200
Length of Installed Pipelines (km)[5]	Single OCS Oil and Gas Lease Sale	0-36	0-39	9-45	41-392	34-520	84-1,032
Length of Installed Pipelines (km)[5]	Cumulative	174-575	142-322	222-809	1,213-2,732	1,455-3,542	3,206-7,980
Service-Vessel Trips (1000's of trips)	Ongoing	0-72	0-40	1-48	4-77	4-79	9-315
Service-Vessel Trips (1000's of trips)	Single OCS Oil and Gas Lease Sale	0-35	0-39	0-12	1-28	1-39	2-153[1]
Service-Vessel Trips (1000's of trips)	Cumulative	39-219	27-86	36-238	100-273	95-283	297-1,099
Helicopter Operations (1000's of operations)[6]	Ongoing	0-13	0-16	0-9	0-52	0-137	0-227
Helicopter Operations (1000's of operations)[6]	Single OCS Oil and Gas Lease Sale	0-8	0-7	0-2	0-9	1-24	1-50
Helicopter Operations (1000's of operations)[6]	Cumulative	3-74	3-33	3-41	28-204	112-486	147-838

Note: Ongoing and single sale-related activity assumes the lifespan of a lease for 40 years. Cumulative-related activities assume continued proposed OCS oil and gas lease sale activity and assumes 70 years of activities.

[1] Subtotals may not add up to the proposed OCS oil and gas lease sale area total because of rounding.

[2] Development and Production Wells includes some exploration wells that were re-entered and completed. These wells were removed from the Exploration and Delineation well count.

[3] Total oil and gas development and production well forecast combined.
[4] Subsea Structures include subsea systems, pipeline end modules, manifolds, and pipeline end terminals.
[5] Projected length of pipelines include umbilical lines, jumpers, and subsea tie-ins; it does not include length in State waters.
[6] Helicopter trips may include circuits. This means that each take-off and landing is counted as a trip and is not necessarily one trip offshore or one trip onshore. Trips may occur between platforms or across a water depth.

The G&G survey activities associated with a single representative proposed OCS oil and gas lease sale are provided in **Table 3.3-3**. A summary of each survey type is provided above in **Table 3.2-1** with greater detail found in Chapter 1.3.3 of the GOM Oil and Gas SID and Appendix F of the *Gulf of Mexico OCS Proposed Geological and Geophysical Activities: Western, Central, and Eastern Planning Areas; Final Programmatic Environmental Impact Statement* (BOEM 2017b).

Table 3.3-3. Geological and Geophysical Survey Activities Associated with a Single Representative Proposed OCS Oil and Gas Lease Sale.

Activity Type – Activity Level	G&G Permit (line miles)	G&G Blocks (number of surveys)
HRG – Low	270-450	N/A
HRG – High	2,300-3,840	N/A
CSEM – Low	N/A	0
CSEM – High	N/A	0-1
VSP – Low	2-3	N/A
VSP – High	20-34	N/A
Deep Seismic (3D WAZ) – Low	N/A	0
Deep Seismic (3D WAZ) – High	N/A	1-2
Deep Seismic (4D WAZ) – Low	N/A	0
Deep Seismic (4D WAZ) – High	N/A	1-2

3D = three dimensional; 4D = four dimensional; CSEM = controlled source electromagnetic; G&G = geological and geophysical; HRG = high-resolution geophysical; VSP = Vertical Seismic Profile; WAZ = Wide-Azimuth.

Note: The activity level for the low case G&G survey scenario assumes 54-90 lease blocks. The activity level for the high case scenario assumes 460-768 lease blocks.

3.3.3 Impact-Producing Factor Relationship to Expected Activity Scenario

To focus the analysis on the issues potentially causing impacts to resources, this Programmatic EIS groups IPFs into eight overarching issue categories (e.g., noise and bottom disturbance) for routine OCS oil- and gas-related activities, and those same eight categories are analyzed for the non-OCS oil- and gas-related activities. Three IPF categories were considered for accidental OCS oil- and gas-related events. Both OCS oil- and gas-related activities, as well as other, non-OCS oil- and gas-related activities, can contribute to one or multiple IPF categories. **Table 3.3-4** identifies the relationship between IPF categories and each of the activities associated with a proposed OCS oil and gas lease sale, as identified in **Table 3.3-2**. Each IPF category is described in further detail below.

Table 3.3-4. Relationship Between Oil and Gas Scenario Activities and Impact-Producing Factors Categories.

Activity	Air Emissions and Pollution	Discharges and Wastes	Bottom Disturbance	Noise	Coastal Land Use/Modification	Lighting and Visual Impacts	Offshore Habitat Modification/Space Use	Socioeconomic Changes and Drivers	Unintended Releases into the Environment	Response Activities	Strikes and Collisions
G&G Survey Activity	X	X	X	X	-	X	X	X	X	-	X
Exploration and Delineation Wells	X	X	X	X	-	X	X	X	X	X	-
Development and Production Wells	X	X	X	X	-	X	X	X	X	X	-
Offshore Production Structures Installation	X	X	X	X	-	X	X	X	X	X	-
Subsea Structures Installation	X	X	X	X	-	X	X	X	X	X	-
Production Structures Removed Using Explosives	X	X	X	X	-	X	X	X	X	X	X
Other Structure Removal	X	X	X	X	-	X	X	X	X	X	X
Pipeline Installation	X	X	X	X	X	X	X	X	X	X	-
Service Vessel Trips	X	X	-	X	X	X	-	X	X	X	X
Helicopter Operations	X	-	-	X	X	X	-	X	X	-	X

3.4 ROUTINE ACTIVITIES

BOEM identified the following IPF categories that commonly occur as a result of oil and gas exploration, development, production, and decommissioning on the Gulf of Mexico OCS as discussed in **Chapter 3.2**.

3.4.1 Air Emissions and Pollution

The activities associated with OCS oil and gas leasing that emit air emissions include (1) use of G&G survey vessels, (2) use of drilling and production vessels, and associated vessels, (3) use of support helicopters, (4) pipelaying operations, (5) flaring and venting, and (6) decommissioning of facilities and pipelines. Emissions from these activities would occur during exploration, development, production, installation, and decommissioning activities. **Table 3.4-1** lists the phase types and related equipment that are sources of emissions. For more information on how air emissions from OCS oil- and gas-related activities are reviewed and permitted, refer to Chapter 5.6 of the GOM Oil and Gas SID.

Table 3.4-1. Sources of Emissions from OCS Oil- and Gas-Related Activities.

Phase Type	Source Type of Emissions	Potential Air Pollutants
Geological and Geophysical Surveys (including ancillary activities)	Diesel or gasoline engines	PM, CO, SO_2, NO_x, NH_3, VOCs, Pb, GHGs, and some HAPs
Exploration	Diesel or gasoline engines; fugitives (i.e., leaks from equipment components); losses from flashing (i.e., unrecovered gas); mud degassing; natural gas engines; natural gas, diesel, or dual fuel turbines; pneumatic controllers; and pneumatic pumps	PM, CO, SO_2, NO_x, NH_3, VOCs, Pb, GHGs, and some HAPs
Development	Diesel or gasoline engines; fugitives (i.e., leaks from equipment components); losses from flashing (i.e., unrecovered gas); mud degassing; natural gas engines; natural gas, diesel, or dual fuel turbines; pneumatic controllers; and pneumatic pumps	PM, CO, SO_2, NO_x, NH_3, VOCs, Pb, GHGs, and some HAPs
Production	Diesel or gasoline engines; fugitives (i.e., leaks from equipment components); losses from flashing (i.e., unrecovered gas); mud degassing; natural gas engines; natural gas, diesel, or dual fuel turbines; pneumatic controllers; pneumatic pumps; amine units; boilers/heaters/burners; cold vents; glycol dehydrator units; loading operations (i.e., losses of vapors from tanks); and storage tanks	PM, CO, SO_2, NO_x, NH_3, VOCs, Pb, GHGs, and some HAPs
Decommissioning, Abandonment, and Removal Operations	Diesel or gasoline engines	PM, CO, SO_2, NO_x, NH_3, VOCs, Pb, GHGs, and some HAPs

CO = carbon monoxide; GHG = greenhouse gas; HAP = hazard air pollutant; NH_3 = ammonia; NO_x = nitrogen oxide; Pb = lead; PM = particulate matter; SO_2 = sulphur dioxide; VOC = volatile organic compound.

3.4.2 Discharges and Wastes

The primary operational wastes and discharges generated during offshore oil and gas exploration and development are drilling fluids, drill cuttings, various waters (e.g., bilge, ballast, fire, and cooling), deck drainage, sanitary wastes, and domestic wastes. During production activities, additional waste streams include water-based drilling mud and cuttings, produced water, produced sand, and well-treatment, workover, and completion fluids. Minor additional discharges may include desalination unit discharges, blowout preventer fluids, boiler blowdown discharges, excess cement slurry, several fluids used in subsea production, and uncontaminated fresh water and salt water. Water discharges from onshore facilities are from either point sources, such as a pipe outfall, or nonpoint sources, such as rainfall run-off from paved surfaces. Accidental oil spills and other types of unintended releases that can occur as a result of existing or future oil and gas operations in the GOM are addressed separately in **Chapter 3.5**. For more detailed descriptions of discharges and wastes, refer to Chapter 2.2 of the GOM Oil and Gas SID.

Discharges associated with oil- and gas-related activities in the Gulf of Mexico are permitted by the USEPA through the issuance of National Pollutant Discharge Elimination System (NPDES) general permits under the Clean Water Act. Refer to Chapters 5.1.1 and 5.11 of the GOM Oil and Gas SID (BOEM 2023e) and BOEM's *Gulf of Mexico OCS Regulatory Framework* technical report (BOEM 2020a) for more information about the Clean Water Act and BOEM and BSEE's approval processes and compliance programs pertaining to OCS oil- and gas-related discharges and wastes.

Effective May 11, 2023, the Region 6 NPDES General Permit for offshore oil and gas in the central to western portions of the GOM has been reissued and has an expiration date of May 10, 2028. The current permit and the fact sheet noting all updates to the permit can be found at the NPDES General Permit for Offshore Oil and Gas Operation in the Western Gulf of Mexico (GMG290000) website (USEPA 2023h). A clarification of note in the reissued permit is that "operators must flush and capture the materials contained in pipelines, umbilicals, and other equipment prior to disconnection. No releases or discharges of fluid from pipelines, umbilicals, and/or other equipment that have not been fully flushed prior to being disconnected or cut from the facility are authorized under this NPDES permit." The Region 4 NPDES permit for offshore oil and gas in the eastern portion of the Gulf of Mexico was reissued on February 12, 2024, and expires on April 3, 2029. Onshore facilities would be issued general or individual permits, from the USEPA or USEPA-authorized State program, that limit discharges specific to the facility type and the waterbody receiving the discharge. Other wastes generated at these facilities would be handled by local municipal and solid-waste facilities, which are also regulated by the USEPA or a USEPA authorized State program. From the above list of wastes and discharges generated during offshore oil and gas activities, select ones are highlighted below to reflect new information and updates since the publication of the GOM Oil and Gas SID. The annual volume of produced waters has been updated through 2022, categorized by depth. Further, a joint industry study was published (AECOM and Marine Ventures International 2021) and focused on well -treatment, completion, and workover fluids discharged in the GOM.

3.4.2.1 Produced Waters

Produced waters can include formation water; injection water; well-treatment, completion, and workover compounds added downhole (including flowback water); and compounds used during the oil and water separation process. It is the largest volume waste stream from oil and gas production. BOEM has reexamined the information for discharges and wastes presented in Chapter 2.2.1.3 of the GOM Oil and Gas SID. The information provided below updates permitting information and information on the volume of produced water in the OCS.

BOEM maintains records of the volume of water produced from each leased block on the OCS and its disposition—injected on lease, injected off lease, transferred off lease, or discharged overboard. The amount discharged overboard for the years 2000-2022 is summarized by water depth in **Table 3.4-2**. The total volume for all water depths during this 10-year period ranged from 324.2 to 648.2 million barrels of water, with the largest contribution (45-88%) coming from operations on the shelf.

Table 3.4-2. Annual Volume of Produced Water Discharged by Depth (millions of barrels).

Year	Shelf (0-60 m)	Shelf (60-200 m)	Slope (200-400 m)	Deepwater (400-800 m)	Deepwater (800-1,600 m)	Ultra-Deepwater (1,601-2,400 m)	Ultra-Deepwater (>2,400 m)	Total
2012	240.8	108.9	20.8	35.0	71. 5	32.3	0.1	509.4
2013	248.8	104.2	20.0	33.1	76.0	36.9	0.3	519.3
2014	248.7	97.2	18.5	35.7	79.5	50.0	1.0	530.7
2015	243.9	102.1	15.0	40.8	83.2	50.6	1.3	537
2016	232.5	100.6	15.8	38.7	86.9	55.4	1.0	530.9
2017	211.9	93.4	14.7	33.4	82.8	65.6	1.6	503.4
2018	198.4	93.3	14.7	32.1	73.5	72.2	1.7	485.9
2019	180	82.7	15.5	29.3	80.3	84.7	2.3	474.8
2020	120.8	53.8	11.5	24.0	70.5	74.6	2.8	358
2021	106.9	52.9	9.3	21.7	76.5	84.9	3.5	355.7
2022	101.1	46.1	6.5	22.1	74.6	71.0	2.8	324.2

Source: Gravois, official communication (2023).

3.4.2.2 Well-Treatment, Workover, and Completion Fluids

Well-treatment fluids are chemicals applied during the oil and gas extraction process. A wide variety of chemicals are used, including corrosion and scale inhibitors, bactericides, paraffin solvents, demulsifiers, foamers, defoamers, and water treatment chemicals (Boehm et al. 2001). Completion fluids are used to displace the drilling fluid and protect formation permeability. Workover fluids are used to maintain or improve existing well conditions and production rates on wells that have been in production. Workover operations include casing and subsurface equipment repairs, re-perforation, acidizing, and stimulating via hydraulic fracturing. A 2001 study discusses completion, stimulation, and workover chemicals that are used in the Gulf of Mexico. This study lists and defines the types of chemicals used as well as providing examples for each category of chemical (Boehm et al. 2001, Table 3).

The USEPA Regions 4 and 6 allow the discharge of well-treatment, completion, and workover fluids if they meet the conditions of the NPDES permits. These regions prohibit the discharge of well-treatment, completion, and workover fluid with additives containing priority pollutants (e.g., benzene, toluene, lead, and mercury; the full list of priority pollutants can be found in Appendix A of 40 CFR part 423). Additives containing priority pollutants must be monitored and those records kept. The well-treatment, completion, and workover fluids commingled with produced waters have technology-based and water quality-based limits. The well -treatment, completion, and workover fluids not commingled with produced waters discharged have technology-based effluent limits. Further detail can be found in Chapter 2.2.1.4 of the GOM Oil and Gas SID.

Additional details on well-treatment, completion, and workover discharges can be found in the joint industry study on well-treatment, completion, and workover effluents discharged to the GOM (AECOM and Marine Ventures International 2021). The study was conducted to fulfill the requirements of the USEPA's general Gulf of Mexico NPDES permits at that time and revealed that discharges from well-treatment, completion, and workover fluids were brief and small in volume with the median sampled discharge duration being 1 hour and the median sampled discharge volume being 473 barrels (bbl). The authors suggested that treatment, completion, and workover discharges are not likely to pose a greater environmental risk than produced-water discharges given the brief duration and small volume of these discharges. Toxicity of completion fluids was associated with calcium concentrations while the toxicities of workover and treatment fluids were correlated with total organic carbon, dissolved organic carbon, and total suspended solids.

3.4.2.3 Vessel Discharges

Vessels may also discharge some wastes to offshore waters. Vessel discharges are regulated through the Vessel Incidental Discharge Act (VIDA), which establishes national standards for discharges incidental to the normal operation of primarily non-military and non-recreational vessels 79 ft (24 m) or greater in length into the waters of the United States or the waters of the contiguous zone. The U.S. Coast Guard (USCG) is tasked with developing implementation, compliance, and enforcement regulations for those standards (USEPA 2023i). For further details, refer to Chapter 2.2.1 of the GOM Oil and Gas SID.

3.4.3 Bottom Disturbance

Bottom disturbance can be caused by activities associated with offshore oil and gas exploration, production, and decommissioning. The largest impact-producing factors include drilling, subsea infrastructure (including pipeline and umbilical installations), and anchor emplacement and infrastructure removals (including site clearance trawling). Some decommissioned structures, with reef-in-place permit approval, may be partially removed or toppled in place in their current OCS block locations. In addition, decommissioned structures may be fully removed or transported to a pre-approved reef site. While production structures are generally removed, it is anticipated that the majority of pipelines and other appurtenances or types of equipment (e.g., manifolds, pipeline end terminals, umbilical lines, etc.) would be allowed by BSEE to remain on the seafloor (i.e., decommissioned in place), as allowed under certain conditions in 30 CFR part 250 and which includes additional NEPA review by BOEM (refer to Chapter 5 of the GOM Oil and Gas SID). Therefore, additional impacts from bottom disturbances associated with pipeline, umbilical, or other appurtenance removals may be minimized. Although additional bottom disturbances would be minimized, there would be permanent impacts associated with decommissioning in-place subsea infrastructure. BSEE may not allow abandonment in place for pipelines installed in areas of the GOM determined to have near-surface sand or mixed sediments that could be valuable for flood control or coastal restoration (i.e., significant sediment resource areas). Based on current industry practices and the application of lease stipulations, NTLs, conditions of approval, and other regulatory requirements, it is anticipated that wells would be drilled on soft seabed and that sensitive benthic features on hard bottoms or with topographic relief would be avoided. Chapters 2.3 and 2.3.1 of the GOM Oil and Gas SID provide detailed descriptions of activities associated with these IPFs.

3.4.4 Noise

Noise is generated from offshore oil- and gas-related activities including G&G surveys, vessels, helicopters and aircraft traffic, drilling and production operations, pipeline trenching, construction, and decommissioning. Noise from these activities is described in more detail in Chapter 2.4 of the GOM Oil and Gas SID. Sound sources can generally be divided into two categories, impulsive and non-impulsive.

3.4.4.1 Impulsive Sound Sources

Impulsive noises are generally considered powerful sounds with relatively short durations, broadband frequency content, and rapid rise times to peak levels. Impulsive or pulsed sounds associated with offshore oil- and gas-related activities include impact pile driving (platforms and well casings), seismic airguns, some HRG sources (e.g., sub-bottom profilers and sparkers), and explosive severance methods for decommissioning.

Airgun noise frequency ranges from 10 to 5,000 hertz (Hz), with most acoustic energy concentrated below 250 Hz. Airguns are the most common impulsive sound source used by the offshore oil and gas industry. Impact pile driving also generates a high energy acoustic pulse with each hammer strike, which operates at a rate of 15-60 blows per minute and requires 500-5,000 strokes to drive the pile into the seabed (Jiménez-Arranz et al. 2020a). In addition, platforms may be removed with explosives placed inside platform legs or conductors 15 to 25 ft (4.6 to 7.6 m) below the seafloor, creating short-term, but potentially substantial impulsive noise. Frequencies for additional sources are provided in Chapter 2.4 and Figure 4.3.6-3 of the GOM Oil and Gas SID.

3.4.4.2 Non-Impulsive Sound Sources

Non-impulsive noise associated with offshore oil- and gas-related activities generally includes all other noise and includes continuous anthropogenic noise from vessels, aircrafts, drilling and production, pipe-laying, and mechanical severance methods for decommissioning. The noise generated by vessels generally increases with vessel size and vessel speed (Jiménez-Arranz et al. 2020b). The primary sources of vessel noise are the propeller and machinery. Machinery noise can be continuous or transient and can vary in intensity.

Helicopters and fixed-wing aircraft generate noise from their engines, airframe, and propellers, which can be substantial in the air when flying near sensitive areas such as national parks and wildlife refuges, or if near surfacing marine mammals or other sensitive species. Noise from passing aircraft is more localized in water than it is in air, however, and typically is limited to frequencies <1,000 Hz (Richardson et al. 1995).

The main sources of sound during offshore drilling and production include machinery and drilling equipment such as pumps, compressors, and generators; mechanical noise from the drill; dynamic positioning and propulsion systems; and associated aircraft and vessel support. Mechanical (i.e., non-explosive) severance methods such as tungsten-carbide blade, diamond wire or hydraulic sheer cutters to remove decommissioned platforms and caissons creates non-impulsive noise as opposed to the impulsive sound created from explosives. Vessel and helicopter traffic would also occur in the vicinity of platforms undergoing decommissioning.

Offshore pipe-laying uses plow and jet burial, which generates continuous, transient, and variable sound levels typically 20-1,000 Hz in frequency range (Nedwell and Edwards 2004). Pipe-laying activity itself is unlikely to have a noticeable contribution to the sound field. The largest contribution comes instead from the pipe-laying vessel(s), supply ships and tugs, moving anchors, trenching and backfilling (Johansson and Andersson 2012). During pipe-laying, up to 10 vessels can operate in the same area, which would also contribute to the overall sound levels (Jiménez-Arranz 2020b).

3.4.5 Coastal Land Use/Modification

Coastal infrastructure, for the purposes of BOEM's analysis, refers specifically to onshore oil- and gas-related infrastructure that provides support for offshore OCS oil- and gas-related activities. Many of these impacts occur in counties and parishes along the Gulf of Mexico region. BOEM aggregates 133 GOM counties and parishes into 23 Economic Impact Areas (EIAs) based on economic and demographic similarities among counties/parishes (**Figure 3.4-1**).

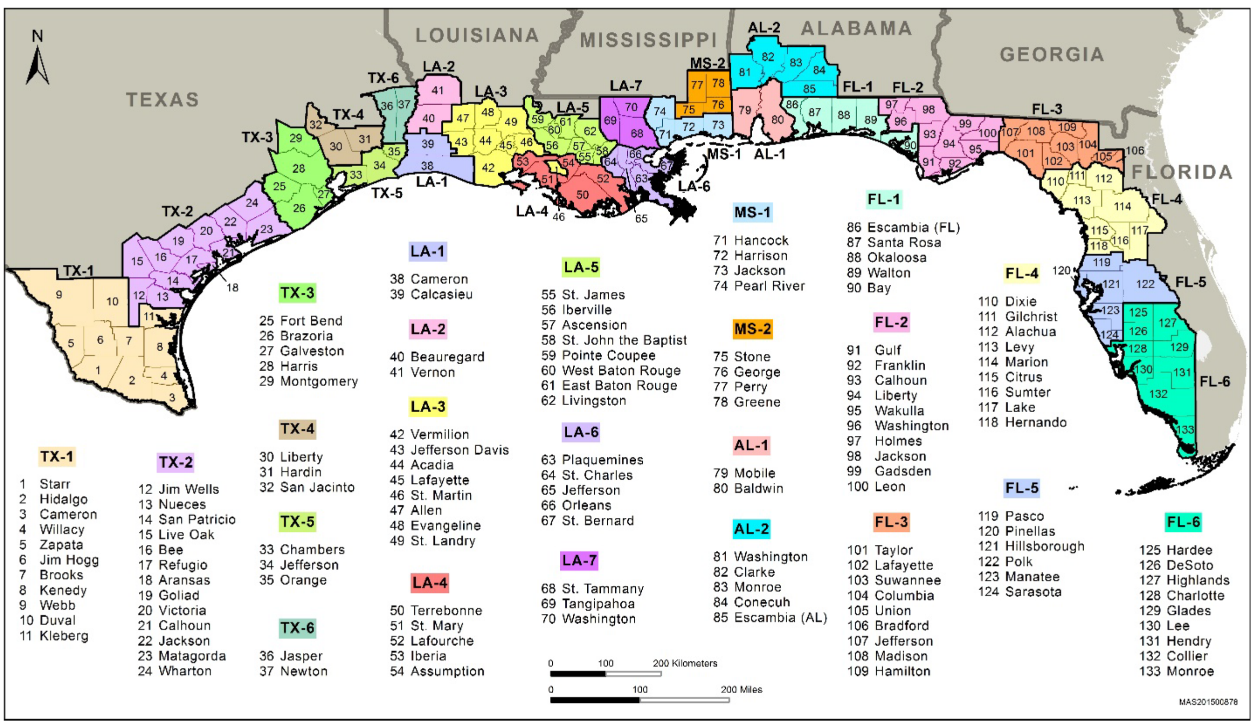

Figure 3.4-1. Economic Impact Areas in the Gulf of Mexico Region (Varnado and Fannin 2018).

Oil and gas exploration, production, and development activities on the OCS are supported by an expansive and mature onshore infrastructure industry that includes large and small companies providing an array of services from construction facilities, service bases, and waste disposal facilities to crew, supply, and product transportation, as well as processing facilities. Existing onshore oil and gas infrastructure is expected to be sufficient to handle development associated with a proposed action. Should there be some expansion at current facilities, the land in the analysis area is sufficient to handle such development. While a proposed OCS oil and gas lease sale and subsequent OCS oil- and gas-related activity would contribute to the continued need for maintenance dredging of existing navigation channels. A mature network of navigation channels already exists in the analysis area; therefore, new navigation channel construction as a direct result of a future proposed OCS oil and gas lease sale is not likely (Dismukes 2011).

The activities and factors outlined in Chapter 2.5.1 of the GOM Oil and Gas SID reflects the already well-established industrial infrastructure network in the GOM region and fluctuations in OCS oil- and gas-related activity levels. The primary sources for the information on coastal infrastructure and activities presented in the GOM Oil and Gas SID are BOEM's New Orleans Office's fact books: (1) *OCS-Related Infrastructure in the Gulf of Mexico Fact Book* (The Louis Berger Group Inc. 2004); (2) *Fact Book: Offshore Oil and Gas Industry Support Sectors* (Dismukes 2010); and (3) *OCS-Related Infrastructure Fact Book; Volume I: Post-Hurricane Impact Assessment* and *Volume II: Communities in the Gulf of Mexico* (Dismukes 2011; Kaplan et al. 2011b). The GOM Oil and Gas SID is incorporated by reference.

3.4.6 Lighting and Visual Impacts

As described in Chapter 2.6 of the GOM Oil and Gas SID, this IPF broadly addresses the extent to which offshore activities (both OCS oil- and gas-related and other factors) introduce infrastructure presence and produce light emissions that (1) create annoyance or interfere with activities; (2) contrast with, or detract from, the visual resources and/or the visual character of the existing environment; or (3) provide safety and security by illuminating dark areas. Visual effects can be difficult to define and assess because they involve subjectivity.

The placement or removal of infrastructure, both offshore and onshore, could alter the existing landscapes and seascapes. Depending on the location of offshore blocks leased and whether or not those blocks are successfully explored and developed, nearby coastal areas could experience the introduction of new infrastructure and increased activity both offshore and onshore that could alter the visual aesthetics of the existing coastal landscapes and seascapes. Many of these potential impacts arise from new structures and activities visible during the day, but there are also potential impacts that could arise from the lighting used on platforms, service vessels, and coastal infrastructure, including night sky disturbances, especially for visitors at State or National parks (refer to Chapters 2.7.2.1 and 4.4.5.2 of the GOM Oil and Gas SID).

3.4.7 Offshore Habitat Modification/Space Use

As described in Chapters 2.7 and 2.7.1 of the GOM Oil and Gas SID, habitats and other specific areas of the OCS offer environmental, recreational, economic, historical, cultural, and/or social values in the same geographic area. Modification and/or use of these areas can be divided based on which space or habitat is being used, i.e., the space above the water (airspace), the water column, and the seafloor.

Leasing on the OCS results in operations that occupy OCS space for dedicated. Likewise, the placement or removal of infrastructure can create alterations to the existing land- and seascapes (i.e., the physical habitat) including seabed, water column, and/or sea surface habitats. The OCS oil- and gas-related operations that can potentially create, remove, modify, or occupy space or habitat(s) include G&G surveys, bottom surveys, pipelines and subsea systems, and the installation of surface or subsurface bottom-founded production structures with anchor cables and safety zones. Service-vessel and helicopter traffic in support of OCS oil and gas development would also occupy space above the water surface.

3.4.8 Socioeconomic Changes and Drivers

As described in Chapters 2.8 and 2.8.1 of the GOM Oil and Gas SID, this IPF broadly addresses the extent to which OCS oil- and gas-related activities produce socioeconomic changes. Because people plan for, instigate, avoid, and react to changes in myriad ways, socioeconomic considerations (e.g., a transition to renewable energy resources) are also drivers of change in the offshore oil and gas industry and elsewhere in society. Changes, in turn, cause additional changes with their own impacts. These impacts are often interpreted subjectively and can be perceived as positive, negative, or neutral, often simultaneously, for multiple reasons and by multiple groups of people.

The oil and gas industry is one element in the socioeconomic landscape of the GOM. The GOM's socioeconomic landscape is rich and varied, representing diverse peoples, cultures, ways of life, and industries. There are six economic sectors that depend on the ocean, including living resources (e.g., seafood), marine construction, marine transportation, offshore mineral extraction (mostly comprised of offshore oil and gas activities), ship and boat building, and recreation and tourism.

Offshore oil and gas activity in the GOM contributes substantially to regional employment and incomes arising from industry expenditures, government revenues, corporate profits, and other market impacts. The GOM ocean economy is dominated by offshore mineral extraction, which puts this region at the top in terms of gross domestic product when compared to the marine economy of other U.S. regions analyzed by NOAA (NOAA 2019). Likewise, the GOM ocean economy has above-average wages, which is largely due to the high wages found in the offshore mineral extraction sector (NOAA 2019). The heavy presence of the oil and gas industry also contributes to the culture and sense of place in many communities in the GOM region, many of which are concentrated along the adjacent coasts.

3.5 Accidental Events

While industry practices and government regulations minimize the risks, the potential for oil spills and other accidental events as a consequence of routine activities or operations throughout the lifetime of a lease still exists. Accidental events are unauthorized events. They are examined separately due to their potential to occur and cause significant human and environmental impacts. Types of reasonably foreseeable accidental events include releases into the environment (e.g., oil spills, loss of well control, accidental air emissions, pipeline failures, chemical and drilling fluid spills, and trash and debris), strikes and collisions (e.g., helicopter, service vessels, platforms, and protected species), and response activities. Substantial preventative measures and Federal regulatory requirements from prevention to accident response are summarized below and described in greater detail in Chapter 2.9 of the GOM Oil and Gas SID.

3.5.1 Unintended Releases into the Environment

3.5.1.1 Oil and Chemical Spills

Oil Spills and Oil-Spill Analysis Summary

The following sections discuss aspects of oil spills relevant to potential oil and gas exploration and development activities in OCS planning areas along the Gulf Coast. Oil-spill events cannot be predicted but the likelihood of their occurrences can be estimated using spill rates derived from historical data and projected volumes of oil production and transportation. BOEM uses the Oil Spill Risk Analysis (OSRA) model to estimate the probability of future oil spills and their estimated trajectories (Ji and Schiff 2023). This model uses the most recent historical oil-spill occurrence rates (ABS Consulting Inc. 2016) in conjunction with projected oil production and transportation volumes to provide reliable estimations. In addition to the analysis of offshore spills provided by the OSRA report, this chapter also summarizes information pertaining to coastal spills and historical trends in OCS spills (refer to Chapter 2.9.1.1. of the GOM Oil and Gas SID).

The results for the two spill size categories analyzed in the OSRA report (>1,000 bbl and >10,000 bbl) are discussed in this chapter in addition to historical spill rates. Spills <1,000 bbl are not analyzed in the OSRA model for two major reasons. First, they are unlikely to persist long enough in the environment for adequate trajectory simulation. Shortly after oil is spilled in an ocean environment, physical and chemical processes (i.e., weathering) begin affecting and modifying the oil. Different crude oils have different chemical compositions that are governed primarily by the geologic conditions under which they were formed, formations through which it migrated, and reservoirs where it accumulated. Collectively, these factors influence the transport and fate of an oil spill. Second, data on spills <1,000 bbl have the potential for greater error owing to the difficulty in estimating spill volumes with sizes that small and for variable reliability in reporting. Taken together, this makes an OSRA model analysis of spills >1,000 bbl and >10,000 bbl more robust than would be possible with spills <1,000 bbl.

Numerous oils collected from the GOM (U.S. waters) are included in Environment Canada's (2022) oil properties database. The database provides details of an oil's chemical composition. The American Petroleum Institute gravity is a common measure of the relative density of crude oil and is expressed in degrees (°API) with water having a value of 10° API. An API greater than 10° indicates that the oil will float on water. The database includes API gravities; GOM oils are in the range of 15° to 60°. **Table 3.5-1** describes the properties and persistence of oil by component groups.

Table 3.5-1. Properties and Persistence by Oil Component Group.

Properties and Persistence	Light Weight	Medium Weight	Heavy Weight
Hydrocarbon Compounds	Up to 10 carbon atoms	10-22 carbon atoms	>20 carbon atoms
API °	>31.1°	31.1°-22.3°	<22.3°
Evaporation Rate	Rapid (within 1 day) and complete	Up to several days; not complete at ambient temperatures	Negligible
Solubility in Water	High	Low (at most a few mg/L)	Negligible
Acute Toxicity	High due to monoaromatic hydrocarbons (BTEX)	Moderate due to diaromatic hydrocarbons (naphthalenes – 2 ring PAHs)	Low, except due to smothering (i.e., heavier oils may sink)
Chronic Toxicity	None, does not persist due to evaporation	PAH components (e.g., naphthalenes – 2 ring PAHs)	PAH components (e.g., phenanthrene, anthracene – 3 ring PAHs)
Bioaccumulation Potential	None, does not persist due to evaporation	Moderate	Low, may bioaccumulate through sediment sorption
Compositional Majority	Alkanes and cycloalkanes	Alkanes that are readily degraded	Waxes, asphaltenes, and polar compounds (not significantly bioavailable or toxic)
Persistence	Low due to evaporation	Alkanes readily degrade, but the diaromatic hydrocarbons are more persistent	High; very low degradation rates and can persist in sediments as tarballs or asphalt pavements

API = American Petroleum Institute; BTEX = benzene, toluene, ethylbenzene, and xylene; mg/L = milligram per liter; PAH = polycyclic aromatic hydrocarbons.
Sources: Lee et al. (2015); Michel (1992).

Analysis of Offshore Spills ≥1,000 bbl

One of the most important factors to consider in an analysis of spills ≥1,000 bbl is the rate at which spills of this size occur. **Table 3.5-2** shows the most recent published spill rates (ABS Consulting Inc. 2016) for multiple size categories and across three spill sources, i.e., platform, pipeline, and both combined. These values are expressed as the number of spills per billion barrels of oil handled (spills/BBO), derived from the distribution of oil spills by spill sources from 2001 through 2015. Spill size categories broken down more than those in **Table 3.5-2** are available in the ABS Consulting Inc. (2016) report. There is an inverse relationship between spill size and spill occurrence rate: as spill size increases, the spill occurrence rate decreases (ABS Consulting Inc. 2016). Note that these oil-spill rate data do not predict the future probability or likelihood of oil spills. The OSRA model provides estimates on the number of future spills and the probability of one or more spills occurring for the >1,000 bbl and >10,000 bbl spill size categories, which are discussed below.

Table 3.5-2. Previously Reported Spill Rates in OCS Offshore Waters from an Accident Related to Rig/Platform and Pipeline Activities.

Spill Size Category (bbl)	Spill Source	Spill Rate (spills/BBO)
10-<50	Combined	16.6
50-<500	Combined	12.5
500-<1,000	Combined	1.6
≥1,000-9,999	Platform	0.25
≥10,000	Platform	0.13
≥1,000-9,999	Pipeline	0.38
≥10,000	Pipeline	0.07

[1] Spill rates are from the most recent update on oil-spill occurrence rates for offshore oil spills in the Gulf of Mexico (ABS Consulting Inc. 2016).

The probabilities for offshore oil-spill occurrence resulting from a single representative proposed GOM oil and gas lease sale and the Cumulative OCS Oil and Gas Program with regards to offshore spills ≥1,000 bbl and >10,000 bbl can be found in the latest OSRA report (Ji and Schiff 2023). These probabilities have ranges that correspond to the low and high regionwide forecasted oil production. For spill volumes ≥1,000 bbl, the probability of one or more spills occurring ranged from 3 percent (for the low production estimate) to 37 percent (for the high production estimate) for a single representative proposed OCS oil and gas lease sale and 30 percent to 99 percent for the Cumulative OCS Oil and Gas Program (see Table A-1 of Ji and Schiff 2023). For offshore oil spills ≥10,000 bbl, the probability ranged from 1 percent to 14 percent for a single representative proposed OCS oil and gas lease sale and from 11 percent to 78 percent for the Cumulative OCS Oil and Gas Program (see Table A-2 of Ji and Schiff 2023). The estimated probability for pipeline spills that are ≥10,000 bbl ranged from <0.5 percent to 5 percent for a single proposed OCS oil and gas lease sale, and 1 percent to 9 percent for platforms. For the Cumulative OCS Oil and Gas Program, these estimates are 4 percent to 41 percent and 7 percent to 63 percent, respectively.

More detailed results are provided in the OSRA report. The OSRA model estimates the chance of oil spills occurring during the production and transportation of a specific volume of oil over the lifetime of the analyzed scenario. The analysis period for a single OCS oil and gas lease sale is 40 years and for the Cumulative OCS Oil and Gas Program it is 70 years. The estimation process uses a spill rate constant, based on historical spills ≥1,000 bbl and ≥10,000 bbl, expressed as a mean number of spills per billion barrels of oil handled. The low estimate and high estimate of projected oil production for a single representative proposed OCS oil and gas lease sale (**Table 3.3-1**) for each alternative and for the Cumulative OCS Oil and Gas Program (2024-2093) are used for this analysis. For more information on OCS spill-rate methodologies and trends, refer to ABS Consulting Inc. (2016), which is the most recent oil-spill occurrence rate report for the Gulf of Mexico. BOEM has developed a study profile that will contract a new report to update oil-spill occurrence rates after 2015 (BOEM 2023a).

On November 16, 2023, an underwater pipeline ruptured approximately 19 mil (31 km) off the southeast coast of Louisiana and has since been sealed to prevent further leakage of oil. Since

November 21, 2023, no new or continuous oil discharge has been reported (NOAA 2023b). The investigation is ongoing, and the maximum potential spill volume for the incident is approximately 26,000 bbl, with indication that it is at least 10,000 bbl in size. Dispersants have not been reported to have been used in response activities (NOAA 2023a), and there have been no reported wildlife or shoreline impacts (USCG 2023).

Offshore Spills <1,000 bbl

BOEM does not provide future estimates or probabilities for spills <1,000 bbl because these are not analyzed by the OSRA model, for the reasons outlined above. However, they are worth noting since spills <1,000 bbl are the most commonly occurring spills and comprise over 98 percent of platform spills that have occurred from 1974 through 2015 and over 96 percent of pipeline spills from 1964 through 2015 (ABS Consulting Inc. 2016). Between 2001 and 2015, the average spill size for pipeline spills was 77 bbl. About 65 percent of platform spills were between 1 and 5 bbl for spill volume, and about 53 percent of pipeline spills fall between 1 and 5 bbl.

Coastal Spills

Spills that occur in State offshore waters and/or navigation channels, rivers, and bays (coastal waters) from barges and pipelines carrying OCS-produced oil are referred to as coastal spills (refer to Chapter 2.9.1.1 of the GOM Oil and Gas SID). These spills occur at shoreline storage, processing, and transport facilities supporting the OCS oil and gas industry. BOEM projects that most (>90%) oil produced following a proposed action under Alternative B, C, or D would be brought ashore via pipelines to oil pipeline shore bases, stored at these facilities, and eventually transferred via pipeline or barge to GOM coastal refineries. Because oil is commingled at shore bases and cannot be directly attributed to a particular OCS oil and gas lease sale, this analysis of coastal spills addresses those that could occur prior to the oil arriving at the initial shoreline facility. It is also possible that non-OCS oil may be commingled with OCS oil at these facilities or during subsequent secondary transport.

The number of spills that have occurred in the GOM by state between January 2002 and July 2015 are detailed in Table 2.9.1-2 of the GOM Oil and Gas SID, although the data made available for researchers by the USCG has not been updated past 2015 (USCG 2015). When limited to just offshore oil- and gas-related spill sources such as platforms, pipelines, MODUs, and support vessels, the number and most likely spill sizes to occur in coastal waters in the future are expected to resemble the patterns that have occurred in the past as long as the level of energy-related commercial and recreational activities remain the same. The coastal waters of Louisiana, Texas, Mississippi, Alabama, and Florida have had a total of 165, 7, 3.2, 0.2, and 0 spills <1,000 bbl/yr, respectively. Assuming future trends would reflect past historical records, it is also predicted that Louisiana would be the state most likely to have a spill ≥1,000 bbl occur in water 0-3 mi (0-5 km) offshore.

Trends in OCS Spills

The overall trend with oil-spill occurrences in the GOM shows a decrease since the 1970s, especially with regards to operational spills that are unrelated to hurricanes (ABS Consulting Inc. 2016;

Chapter 2.9.1.1 of the GOM Oil and Gas SID). Catastrophic spills are rare, and the *Deepwater Horizon* oil spill in 2010 had a volume so large that it overwhelmed the rest of the record of total oil-spill volume (ABS Consulting Inc. 2016; Anderson et al. 2012) and is considered an outlier (Ji et al. 2014). For this reason, the previously mentioned oil-spill occurrence rate reports provide statistical estimates that exclude the *Deepwater Horizon* oil spill. However, it is still accounted for in the baseline for impact analyses in **Chapter 4**. In accordance with CEQ guidelines to provide decisionmakers with a robust environmental analysis, the GOM Catastrophic Spill Event Analysis technical report (BOEM 2021c) provides an analysis of the potential impacts of a low-probability catastrophic oil spill, which is not part of a proposed action and not likely expected to occur, to the environmental and cultural resources and the socioeconomic conditions analyzed in **Chapter 4**.

The dominant factor for the overall decrease in spill occurrences since the 1970s possibly stems from fewer equipment failures, driven by technological improvements and regulations in design and safety of new and existing GOM structures (ABS Consulting Inc. 2016). For example, NTL No. 2007-G26 provided guidance in the design of new OCS platforms and related structures to better withstand hurricane conditions, which have played a significant role in past oil-spill occurrences. From 2001 through 2015, hurricanes were the primary cause of most pipeline spills and caused 4 of the 20 pipeline spills classified as large from 1974 through 2015. Most platform spills were operational (non-hurricane) spills except for the years 2005-2009 where the major cause was multiple hurricane events. For spills after 2015, aggregated data on industry activities from BSEE (for years 2010-2022), which includes data for spill volumes >1-50 bbl and >50 bbl, shows that spill occurrences continue to have low frequency and follow the overall trend since the 1970s (BSEE 2023a). From this data for the years 2016-2022, an average of approximately 8 spills >1 bbl but <50 bbl occurred per year. For spills >50 bbl, an average of 1 spill occurred annually. BOEM has developed a study profile that will contract a new report that updates oil-spill occurrence rates after 2015 (BOEM 2023a).

Chemical and Drilling Fluid Spills

Chemicals and synthetic-based drilling fluids are used in offshore oil and gas drilling and production activities and may be spilled to the environment due to equipment failure, inclement weather, accidental collision, or human error.

Chemicals are stored and used to condition drilling muds during production and in well completions, stimulation, and workover procedures. The chemicals that are used in the largest volumes, well completion, workover, and treatment fluids, generally are spilled in the largest volumes. Zinc bromide, a treatment fluid, is of particular concern because it is persistent (nondegradable) and is comparatively toxic (Chapter 2.2.1.4 of the GOM Oil and Gas SID). The only two chemicals that could potentially impact the marine environment are zinc bromide and ammonium chloride (Boehm et al. 2001). Ammonium chloride transforms to produce ammonia, which is toxic to fishes and other marine life. Other common chemicals spilled include methanol and ethylene glycol, which are used in deepwater operations to prevent gas hydrates formation. These alcohol-based chemicals are nonpersistent (degradable) and exhibit comparatively low toxicity.

Synthetic-based fluid (SBF) has typically been used since the mid-1990s for the deeper well sections because of its superior performance. The synthetic oil used in SBF is relatively nontoxic (compared to crude oil) to the marine environment and has the potential to biodegrade. However, SBF is considered more toxic than water-based drilling fluid, and spills of SBF are categorized separately from water-based fluid releases. Accidental riser disconnections can result in the release of large quantities of drilling fluids like SBFs.

Refer to **Tables 3.5-3 and 3.5-4** for information on spill statistics for chemicals and SBFs for the period of 2012-2022 (BSEE 2023b). BSEE reports spill statistics for chemicals and SBFs in categories of 10-49 bbl (small spills) and >50 bbl (large spills). **Tables 3.5-3 and 3.5-4** show the total annual spill volumes in barrels of product lost for SBFs and chemicals in both spill size categories. The number of spill incidents per year are listed with the mean spill volume in barrels for a given year.

Table 3.5-3. Number and Volume of Chemical Spills that Occurred from 2013 to 2022 in Two Spill Size Categories: Spills Between 10 and 49 Barrels (shaded) and Spills >50 Barrels.

Spill Size (bbl)	Year	Total Product Lost (bbl)	Number of Spills	Mean Spill Volume (bbl)
10-49	2013	20	1	20
10-49	2014	0	0	0
10-49	2015	41	1	41
10-49	2016	78	3	26
10-49	2017	0	0	0
10-49	2018	35	1	35
10-49	2019	0	0	0
10-49	2020	0	0	0
10-49	2021	19	1	19
10-49	2022	42	2	21
>50	2013	0	0	0
>50	2014	66	1	66
>50	2015	628	2	314
>50	2016	1,274	2	637
>50	2017	0	0	0
>50	2018	713	3	238
>50	2019	0	0	0
>50	2020	0	0	0
>50	2021	88	1	88
>50	2022	608	2	304

Table 3.5-4. Number and Volume of Synthetic-Based Fluid Spills that Occurred from 2013 to 2022 in Two Spill Size Categories: Spills Between 10 and 49 Barrels (shaded) and Spills >50 Barrels.

Spill Size (bbl)	Year	Total Product Lost (bbl)	Number of Spills	Mean Spill Volume (bbl)
10-49	2013	51	2	26
10-49	2014	0	0	0
10-49	2015	12	1	12
10-49	2016	0	0	0
10-49	2017	29	1	29
10-49	2018	0	0	0
10-49	2019	0	0	0
10-49	2020	15.6	1	16
10-49	2021	30	1	30
10-49	2022	32.9	2	16
>50	2013	0	0	0
>50	2014	323	1	108
>50	2015	2,712	2	904
>50	2016	175	2	175
>50	2017	165	0	83
>50	2018	2,270	3	757
>50	2019	139	0	46
>50	2020	192	0	96
>50	2021	65	1	65
>50	2022	0	2	0

Losses of Well Control

All losses of well control are required to be reported to BSEE. In 2006, BOEM and BSEE's predecessor (the Minerals Management Service) revised the regulations for loss of well control incident reporting, which were further clarified in NTL No. 2019-N05, "Increased Safety Measures for Energy Development on the OCS." The failure reporting requirement, codified in 30 CFR § 250.730(c) of BSEE's well control rule, went into effect on July 28, 2016. Additionally, on September 28, 2018, BSEE published revisions to the 2018 Oil and Gas Production Safety Systems Rule, which became effective on December 27, 2018 (83 FR 49216); on May 2, 2019, BSEE published revisions to the 2019 Well Control and Blowout Preventer Rule, which became effective on July 15, 2019; and on August 23, 2023, BSEE published a final rule revising certain regulatory provisions published in the 2019 final well control rule for drilling, workover, completion, and decommissioning operations, which became effective on October 23, 2023 (88 FR 57334). BSEE's regulations, including reporting requirements and equipment standards, help to minimize the chance of losses of well control.

The current definition for loss of well control is as follows:

- uncontrolled flow of formation or other fluids (the flow may be to an exposed formation [an underground blowout] or at the surface [a surface blowout]);
- uncontrolled flow through a diverter; and/or
- uncontrolled flow resulting from a failure of surface equipment or procedures.

Not all loss of well control events would result in a blowout as defined above, but it is most commonly thought of as a release to the human environment. A loss of well control could occur during any phase of development, i.e., exploratory drilling, development drilling, well completion, production, or workover operations. A loss of well control could occur when improperly balanced well pressure results in sudden, uncontrolled releases of fluids from a wellhead or wellbore (Neal Adams Firefighters Inc. 1991; PCCI Marine and Environmental Engineering 1999). For more information regarding losses of well control, refer to Chapter 2.9.1.4 of the GOM Oil and Gas SID.

Shallow water flows are another form of well control loss. Shallow water flows can occur when the drill bit encounters shallowly buried sediments having layers or zones with elevated pore pressures. If the drilling mud is not weighted sufficiently to contain the pore pressure, water and loose sediment can travel uphole and exit at the seafloor around the uncemented well annulus. Shallow water flows are not a phenomenon that could release oil or gas into the environment. They can, however, destabilize the well head or drilling platform, sometimes to a degree that requires plugging the well and re-spudding in a different location.

Accidental Air Emissions and H_2S

Accidental air emissions and pollutants could include the release of oil, condensate, or natural gas; chemicals used offshore; pollutants from the burning of these products; fire; or hydrogen sulfide (H_2S) release. The air pollutants could include CAPs, volatile and semivolatile organic compounds, hydrogen sulfide, and methane. Emissions sources related to accidents from OCS operations can include well blowouts, oil spills, pipeline breaks, tanker accidents, and tanker explosions. Accidental air emissions are described in further detail in Chapter 2.9.1.5 of the GOM Oil and Gas SID.

Sulfur may be present in oil as elemental sulfur, within gas as H_2S, or within organic molecules, all three of which vary in concentration independently. Safety and infrastructure concerns include irritation, injury, and even lethality to workers who are exposed to H_2S from leaks; exposure to sulfur oxides produced by flaring; equipment and pipeline corrosion; and outgassing and volatilization from spilled oil. For more information on OCS oil- and gas-related sulfur impacts, refer to Chapter 2.10.1.6 of the GOM Oil and Gas SID.

Trash and Debris

In the United States, about 80 percent of marine debris washes into the ocean from land-based sources and 20 percent is from ocean sources (USEPA 2017). The OCS oil and gas industry makes up only a small part of those sources. Some trash items, such as glass, pieces of steel, and drums with chemical or chemical residues, can be a health threat to local water supplies and as a result, also to biological, physical, and socioeconomic resources; beachfront residents; and to users of recreational beaches. The discharge of marine debris by the offshore oil and gas industry and supporting activities is subject to a number of laws and treaties. These laws and treaties include the Marine Debris Research, Prevention, and Reduction Act; the Marine Plastic Pollution Research and Control Act; and the MARPOL Annex V treaty. Regulation and enforcement of these laws is conducted by a number of agencies, such as the USEPA, NOAA, and USCG. The USEPA works with the International Maritime Organization to develop and implement legal standards that address vessel-source pollution and ocean dumping. The BSEE Marine Trash and Debris Prevention Program is intended to reduce the contribution of the oil and gas industry to marine debris. Lessees are encouraged to use caution when handling and transporting small items and packaging materials, particularly those made of nonbiodegradable, environmentally persistent materials such as plastic or glass that can be lost in the marine environment and washed ashore. Additional guidance for operators is provided in NMFS' Biological Opinion (NMFS 2020b). The various trash and debris laws and regulations would likely minimize the discharge of marine debris from OCS operations.

Occasionally during construction or operation, equipment may be dropped to the seafloor. If this happens within the planned construction or operation site, the bottom-disturbing impacts are conservatively considered as part of the routine impacts considered in the **Chapter 4** resource analysis; however, equipment drops that may occur during transport are considered as accidental and are analyzed as such.

3.5.2 Response Activities

In the event of a spill, particularly a loss of well control, there is no single method of containment and removal that would be 100-percent effective. It is likely that larger spills under the right conditions would require the simultaneous use of all available cleanup methods (i.e., source containment, mechanical spill containment and cleanup, dispersant application, and *in-situ* burning). There are many situations and environmental conditions that necessitate different approaches. Spill cleanup is a complex and evolving technology. Each new tool then becomes part of the spill-response tool kit. Each spill-response technique/tool has its specific uses and benefits (Fingas 1995). Offshore removal and spill-containment efforts to respond to an ongoing spill offshore would likely require multiple technologies, including source containment; mechanical spill containment and cleanup; *in-situ* burning of the slick; and the use of chemical dispersants. Even with the deployment of all of these spill-response technologies, it is likely that, with the operating limitations of today's spill-response technology, not all of the oil can be contained and removed offshore.

The sensitivity of the contaminated shoreline is the most important factor in the development of cleanup recommendations. Shorelines of low productivity and biomass can withstand more intrusive cleanup methods such as pressure washing. Shorelines of high productivity and biomass are very sensitive to intrusive cleanup methods and, in many cases, the cleanup is more damaging than allowing natural recovery. Refer to Chapter 2.9.2 of the GOM Oil and Gas SID for more information on specific spill-response activities. For information on the effects of response activity, refer to **Chapter 4** of this Programmatic EIS.

The USCG is the lead response agency for oil spills on the OCS. Ultimately, and only when deemed necessary, the removal methods used during any spill will be determined by the USCG's Federal On-Scene Coordinator and representatives of the Regional Response Team or National Response Team. As a result of the Oil Pollution Act of 1990, BSEE is also tasked with several oil-spill response duties and planning requirements. Within BSEE, the Oil Spill Preparedness Division addresses all aspects of offshore oil-spill prevention, planning, preparedness, and response. The BSEE implements regulations found at 30 CFR part 250 and 30 CFR part 254. Based on requirements for oil-spill response plans (OSRPs) established in Section 311 of the Federal Water Pollution Control Act (33 U.S.C. § 1321), BSEE reviews and approves all OSRPs and requires lessees to conduct the training, equipment testing, and periodic drills listed in the OSRP. The BSEE also conducts unannounced drills to ensure compliance with OSRPs. Additional information about the Oil Spill Preparedness Division can be found on BSEE's website at http://www.bsee.gov/About-BSEE/Divisions/OSPD/index/. All spills must be reported to the USCG via the National Response Center (refer to the https://www.epa.gov/emergency-response/national-response-center), and all spills ≥1 bbl must be reported to BSEE. The BSEE conducts investigations into spills, may assess civil and criminal penalties, oversees spill source control and abatement operations, and conducts research into spill response in the marine environment.

BOEM implements regulations found at 30 CFR § 550.219 and 30 CFR § 550.250 by receiving and reviewing worst-case discharge information and OSRPs (or references to regional OSRPs) that are submitted for exploration plans, development and production plans, and development operations coordination documents on the OCS. BOEM implements regulations found at 30 CFR part 553 by managing the Oil Spill Financial Responsibility Program, which requires industry to show financial responsibility to respond to possible spills. BOEM implements regulations found at 30 CFR part 553 by managing the Oil Spill Financial Responsibility Program, which requires industry to show financial responsibility to respond to possible spills. BOEM requires that an operator must either submit an initial OSRP to BSEE Oil Spill Preparedness or reference an existing BSEE-approved OSRP prior to approval of an operator-submitted exploration, development, or production plan.

3.5.3 Strikes and Collisions

Strikes are defined as a vessel or aircraft unintentionally hitting a resource or habitat. Collisions are defined as a vessel or aircraft unintentionally hitting another vessel, aircraft, or structure. Both strikes and collisions can occur as a result of routine OCS oil- and gas-related activities, accidental events, or other events that are not associated with OCS oil- and gas-related activities. Whatever the cause of the strike or collision, the result is an accidental event. The leading causes, not all inclusive, of recent helicopter accidents were engine related, loss of control or improper procedures, helideck obstacle strikes, controlled flight into terrain, and other technical failures (Helicopter Safety Advisory Conference 2015). For more information on strikes and collisions, refer to Chapter 2.9.3 of the GOM Oil and Gas SID.

3.6 CUMULATIVE ACTIVITIES

Cumulative effects result from "the incremental effects of the action when added to the effects of other past, present, and reasonably foreseeable actions, regardless of what agency (Federal or non-Federal) or person undertakes such other actions" (40 CFR § 1508.1(g)). Cumulative impacts on a given resource, ecosystem, or human community may result from single actions or a combination of multiple actions over time. These may be additive, less than additive (countervailing), or more than additive (synergistic). The scope of a proposed action is important to consider in a broader context that accounts for the full range of actions and associated impacts taking place within the Gulf of Mexico, currently and into the foreseeable future. Repeated actions, even minor ones, may produce significant impacts over time. Many of the past and present actions and trends that would contribute to cumulative impacts under the action alternatives could also contribute to cumulative impacts under the No Action Alternative (Alternative A).

3.6.1 Cumulative OCS Oil and Gas Program Scenario

The Cumulative OCS Oil and Gas Program scenario includes all activities (i.e., routine activities projected to occur and accidental events that could occur) from past, present, and future proposed GOM oil and gas lease sales. This includes projected activity from past OCS oil and gas lease sales for which exploration or development has either not yet begun or is continuing (i.e., ongoing activities scenario), activities resulting from a single representative proposed OCS oil and gas lease sale, and activities that would result from future proposed OCS oil and gas lease sales that would be held as a result of current or future National OCS Oil and Gas Programs. This equates to a 70-year timeframe or 2024-2093 and includes a 40-year analysis period (2024-2063) for a single representative proposed OCS oil and gas lease sale. Recent development trends show that almost all activities from a single OCS oil and gas lease sale occur within a 40-year period, with some extending up to 50 years. Therefore, BOEM used a 40-year analysis period for the single lease sale scenario but, since some could extend up to 50 years, BOEM conservatively used a 70-year time period for the cumulative scenario. **Table 3.3-2** presents projections of the major activities and impact-producing factors related to future Cumulative OCS Oil and Gas Program activities.

It is reasonable to assume that OCS oil and gas lease sales would continue to be proposed as a result of current or future National OCS Oil and Gas Programs for many years to come in the Gulf of Mexico region based on resource availability and existing infrastructure. Furthermore, language in the Inflation Reduction Act of 2022 indicates that an OCS oil and gas lease sale(s) consisting of an aggregate of 60 million acres must occur in a year prior to issuing an offshore wind lease. For the purposes of conducting cumulative impact analyses, continued leasing activity is assumed to occur, resulting in activities that could occur over the next 70 years. However, forecasting long-term cumulative activity levels (e.g., exploration wells, production wells, and pipelines) is increasingly speculative due to uncertainty related to oil prices, resource potential, transitioning to a cleaner national energy strategy, and the cost of development and resource availability (e.g., drilling rig availability) versus the amount of acreage leased from an OCS oil and gas lease sale.

Although BOEM has analyzed historical information and current trends in the oil and gas industry, BOEM cannot predict future OCS oil- and gas-related activities with a high-level of certainty. The ongoing, single OCS oil and gas lease sale and cumulative scenarios are only approximate since future factors such as the contemporary economic marketplace, the availability of support facilities, and pipeline capacities are all unknowns. Notwithstanding these unpredictable factors, the scenarios used in this Programmatic EIS represent the best assumptions and estimates of a set of future conditions that are considered reasonably foreseeable and suitable for presale impact analyses. The scenarios do not represent BOEM's recommendation, preference, or endorsement of any level of leasing or offshore operations, or of the types, numbers, and/or locations of any onshore operations or facilities for future OCS Oil and Gas Programs.

3.6.2 Non-OCS Oil- and Gas-Related Activities

The non-OCS oil- and gas-related activities considered in this chapter are defined as other past, present, and reasonably foreseeable future activities occurring within the same geographic range and within the same timeframes as the projected routine activities and potential accidental events discussed above, but they are not related to the Cumulative OCS Oil and Gas Program. Chapter 2 of the GOM Oil and Gas SID summarizes non-OCS oil- and gas-related activities that could potentially affect an environmental or socioeconomic resource in addition to OCS oil- and gas-related activity.

While the scenario developed for the Cumulative OCS Oil and Gas Program scenario forecasts 70 years of activities, the scenarios developed as part of this chapter vary in the length of time projected depending on what would be considered reasonably foreseeable based on the data available and the ability to predict future actions without being speculative.

3.6.3 Climate Change

The Earth's climate system is driven by solar radiation, which provides heat to the planet. Increasingly, human-influenced changes to the Earth's atmosphere have slowed the rate at which this incoming solar radiation is re-radiated back into space, resulting in a net increase of energy in the Earth's system (Intergovernmental Panel on Climate Change 2022). The climate's subsequent response is complicated by several positive and negative feedback processes among atmospheric, terrestrial, and oceanic systems, but the overall result is climatic warming, as is evident by observed increases in air and ocean temperatures, melting snow and ice, and rising sea levels (Intergovernmental Panel on Climate Change 2022). These planet-wide chemical and physical changes are collectively referred to as climate change. **Figure 3.6-1** shows factors that have increased and decreased as a result of climate change.

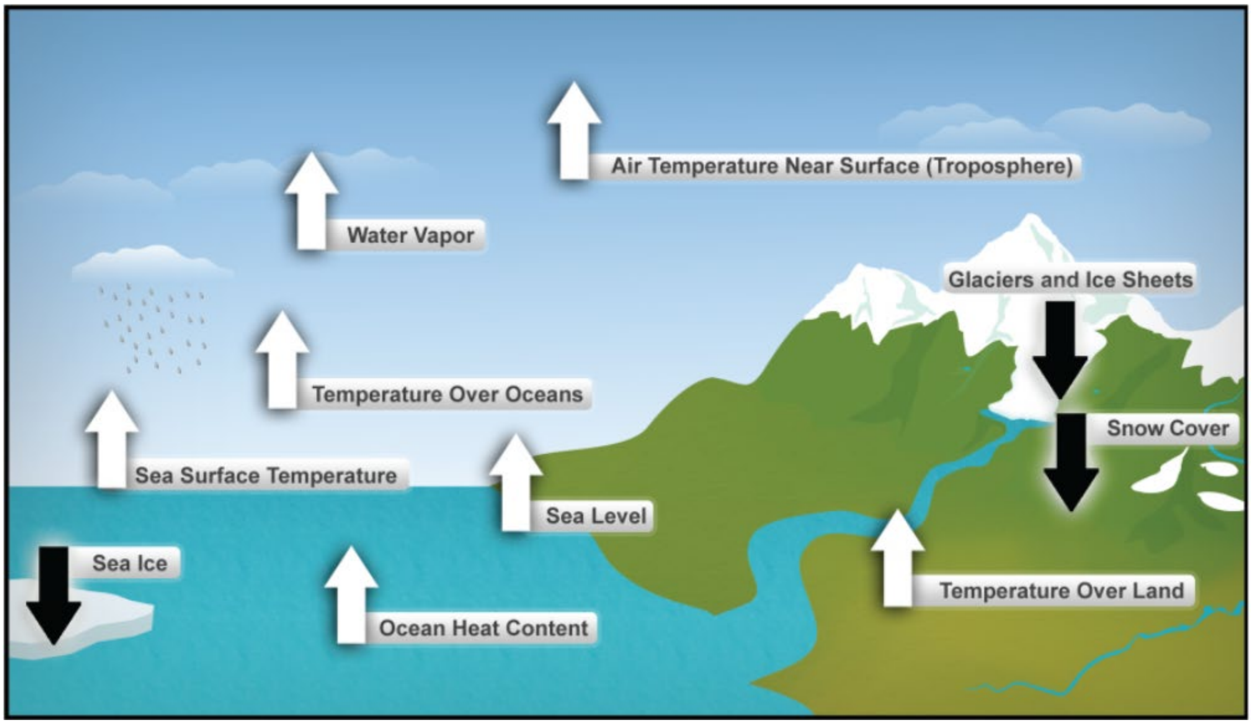

Figure 3.6-1. Effects of Climate Change (white arrows indicate increases and black arrows indicate decreases) (Melillo et al. 2014).

One of the primary drivers of climate change are increasing atmospheric concentrations of greenhouse gases (GHGs) such as carbon dioxide (CO_2), methane (CH_4, also known as natural gas), and nitrous oxide (N_2O) from anthropogenic activities (U.S. Global Change Research Program 2018). In November 2016, BOEM released *OCS Oil and Natural Gas: Potential Lifecycle Greenhouse Gas Emissions and Social Cost of Carbon* (Wolvovsky and Anderson 2016). This report is a comprehensive analysis of potential greenhouse gas emissions that may result from offshore oil and gas leasing. This includes emissions released during offshore operations for which BOEM has jurisdiction, along with the onshore processing, distribution, and consumption of oil and gas products. BOEM updated this analysis for the GOM region in **Appendix H**.

Life-cycle GHG emissions from the proposed action, Alternatives B-D, could impact climate change. Climate change is discussed in detail in Chapter 2.2 of the 2024-2029 National OCS Oil and Gas Program Programmatic EIS and Chapter 3.4 of the GOM Oil and Gas SID and are hereby incorporated by reference. The National OCS Oil and Gas Program Programmatic EIS describes climate change as resulting primarily from the increasing concentration of GHGs in the atmosphere, which causes planet-wide physical, chemical, and biological changes that substantially affect the world's oceans, lands, and atmosphere. The National OCS Oil and Gas Program Programmatic EIS also discusses the causes of climate change (GHG emissions), BOEM's life-cycle GHG analysis, and emissions targets and carbon budgets. These descriptions are useful for the GOM Oil and Gas Programmatic EIS to establish a broad understanding of climate change that can be analyzed at the regional level for this document. For the Intergovernmental Panel on Climate Change's sixth assessment on "Summary for Policymakers" reports there is a high confidence that GHG emissions contributes to global warming and that continued GHG emissions will increase global warming (Intergovernmental Panel on Climate Change 2023). Future impacts to climate change can be lessened, but some impacts are "unavoidable and/or irreversible" (Intergovernmental Panel on Climate Change 2023). Observed harms of climate change were examined by Gevondyan et al. (2023) and include (1) effects of sea-level rise on shoreline degradation and erosion, (2) damages caused by increased severe weather effects, (3) ocean acidification effects, (4) impacts on the health of the environment, (5) impacts on the formation of hypoxic zones, (6) effects on marine life and fisheries, and (7) damages to historically significant heritage sites (Gevondyan et al. 2023). The ongoing impacts of climate change are considered part of the environmental baseline while potential future impacts from climate change are evaluated as part of the cumulative analysis for each resource.

3.6.4 Air Emissions and Pollution

Offshore sources of air pollution not related to OCS oil- and gas-related activities that cause degradation to air quality come from natural (biogenic and geogenic) and anthropogenic sources. Natural offshore sources include, but are not limited to, lightning, sea salt, bacterial processes, and natural oil seeps. Anthropogenic offshore sources include, but are not limited to, commercial vessels (including cruise ships, container ships, and lightering services), military vessels and aircraft, commercial and recreational fishing vessels, site assessment and site characterization activities for offshore wind developments (BOEM 2023d), and the Louisiana Offshore Oil Port.

Onshore sources of air pollution from non-OCS oil- and gas-related activities include power generation, industrial processing, manufacturing, refineries, waste disposal, pesticides, fertilizers, commercial and home heating, and motor vehicles. Natural sources include, but are not limited to, lightning, volcanos, pollen, dust, and other biogenic and geogenic sources.

3.6.5 Discharges and Wastes

Discharges and wastes from non-OCS oil- and gas-related events may derive from discharge from shipwrecks, military activities, dredged material disposal, land-based nonpoint pollution, and natural seeps. Additional sources may also include historical chemical weapon disposal and historical waste dumping. For more information regarding discharges and wastes associated with offshore and onshore activity, refer to Chapter 2.2 of the GOM Oil and Gas SID.

Dredged material is described in 33 CFR part 324 as any material excavated or dredged from navigable waters of the United States. Materials from maintenance dredging are primarily disposed of offshore on existing dredged-material disposal areas and in ocean dredged-material disposal sites (ODMDSs). The USEPA has several designated ODMDS in the GOM, all of which can be accessed on the USEPA website at https://www.epa.gov/ocean-dumping/ocean-disposal-map. Additional information can also be accessed on the U.S. Army Corps of Engineers' Ocean Disposal Database at https://odd.el.erdc.dren.mil/. The USEPA Region 4 Final National Pollutant Discharge Elimination System Permit (General Permit No. GEG460000) for Offshore Oil and Gas Activities in the Eastern GOM (including portions of the CPA) does not allow the discharge of any drilling fluids, drill cuttings, or produced waters from offshore oil and gas facilities within 1,000 m (3,280 ft) (or as determined by the USEPA Director) of any federally designated ODMDS.

Most aquatic pollutants result from agricultural or urban runoff or discrete point source wastewater discharges from industrial sites or sewage plants and are released to streams, rivers, bays, and estuaries. Nonpoint-source pollution is caused by rainfall or snowmelt moving over and through the ground. As the runoff moves, it picks up and carries away natural and human-made pollutants, finally depositing them into lakes, rivers, wetlands, coastal waters, and ground waters. Both discrete point sources and nonpoint sources make their way to coastal waters and the open ocean where they are prevalent impact-producing factors for marine life.

Constituents added to the Mississippi River originate from erosion, uncontained runoff, sediment, suspended solids, organic matter, and pollutants (including nutrients, heavy metals, fertilizer, pesticides, oil and grease, and pathogens). As a result, water quality in coastal waters of the northern GOM is highly influenced by seasonal variation in river flow. The Mississippi River basin alone introduces approximately 104,895 tonnes of oil and grease per year from land-based sources (National Academies of Sciences, Engineering, and Medicine 2022a).

The National Academies of Sciences, Engineering, and Medicine (2022a) computed petroleum hydrocarbon inputs into North American marine waters for several major categories, indicating that land-based runoff, natural seeps, operational discharges, and accidental events are the main sources of anthropogenic petroleum hydrocarbon pollution in the sea. The annual estimates of land-based sources far outweigh other sources, even when factoring in the *Deepwater Horizon* oil spill in 2010 and the worst-case projection for the persisting 2004 oil spill from Taylor Energy's toppled platform in Mississippi Canyon Block 20 into the estimates (National Academies of Sciences, Engineering, and Medicine 2022a). More information on Taylor Energy's toppled platform is discussed in Chapter 2.9.1.1 of the GOM Oil and Gas SID. In accordance with CEQ guidelines to provide decisionmakers with a robust environmental analysis, the GOM Catastrophic Spill Event Analysis technical report (BOEM 2021c) provides an analysis of the potential impacts of a low-probability catastrophic oil spill, which is not part of a proposed action and not likely expected to occur, to the environmental and cultural resources and the socioeconomic conditions analyzed in **Chapter 4**.

Table 3.6-1 provides *Oil in the Sea IV* (National Academies of Sciences, Engineering, and Medicine 2022a) estimates of hydrocarbon inputs into marine waters, which is an update to *Oil in the Sea III* (National Research Council 2003b). Excluding the *Deepwater Horizon* oil spill, there is an approximately 35 percent decrease in petroleum hydrocarbon inputs overall when compared to the 1990-1999 period (National Academies of Sciences, Engineering, and Medicine 2022a). Multiple inputs covered in *Oil in the Sea III* were not reported for *Oil in the Sea IV*, including atmospheric deposition, aircraft jettison, and recreational marine vessels. Operational discharges from commercial vessel estimates are less than 10 metric tons per year total, assuming full compliance with regulations. In general, response activities to non-OCS oil- and gas-related spills would be similar to an OCS oil- and gas-related spill (**Chapter 3.5.1** of this Programmatic EIS and Chapter 2.9.1 of the GOM Oil and Gas SID).

Table 3.6-1. Estimated Annual Inputs of Petroleum Hydrocarbons to the Gulf of Mexico from 2010-2019 (National Academies of Sciences, Engineering, and Medicine 2022a) in Metric Tons per Year. (Estimated loads of <10 metric tons per year were marked as "trace" in *Oil in the Sea III* [National Research Council 2003b]).

Inputs	Petroleum Process	Subzone	Western Gulf of Mexico	Eastern Gulf of Mexico
Seeps	Natural Source	NA	60,000	8,000
Spills (including *Deepwater Horizon*)	Extraction	Offshore	57,161	1.4
Spills (excluding *Deepwater Horizon*)	Extraction	Offshore	18.1	1.4
Spills (including *Deepwater Horizon*)	Extraction	Coastal	70.8	0
Spills (excluding *Deepwater Horizon*)	Extraction	Coastal	70.8	0
Produced Water[1]	Extraction	Coastal	44	6
Produced Water[1]	Extraction	Offshore	1,838	54
Sum of Extraction (including *Deepwater Horizon*)	Extraction	NA	59,113.80	61.4
Sum of Extraction (excluding *Deepwater Horizon*)	Extraction	NA	1,970.90	61.4
Pipeline Spills	Transportation	Offshore	2.1	0
Pipeline Spills	Transportation	Coastal	296.1	11.4
Tank Vessel Spills	Transportation	Offshore	91	0
Tank Vessel Spills	Transportation	Coastal	84.8	2.3
Coastal Terminal Spills	Transportation	Coastal	14.3	174.3
Coastal Refinery Spills	Transportation	Coastal	10.4	0.1
Sum of Transportation	Transportation	NA	498.7	188.1
Vessel <100 GT (spills)	Consumption	Coastal	21.3	2.1
Vessel >100 GT (spills)	Consumption	Coastal	28.4	12.7
Vessel <100 GT (spills)	Consumption	Offshore	24.9	0.3
Vessel >100 GT (spills)	Consumption	Offshore	18.3	1.2
Sum of Consumption	Consumption	NA	92.9	16.3

[1] Assumes a maximum amount of 29 milligrams per liter.

3.6.6 Bottom Disturbance

Seafloor disturbance caused by activities that are not part of the Bureau of Ocean Energy Management's OCS Oil and Gas Program can occur from anchoring, buoys, or moorings; military operations; State oil and gas activities; artificial reefs; dredging and trawling; renewable energy installations; and mass wasting events. Anchors "bite" into the seafloor to secure a vessel in place and work best in areas of soft seafloor sediment. Buoy or mooring fields can be found outside harbors for cargo ships to tie before heading into a port; in smaller ports or harbors for recreational vessels or small commercial vessels to moor; in locations that are marked for fishing, diving, or other recreation; or they may mark avoidance areas such as reefs, fishing nets, or scientific equipment. Many of the operations and training exercises conducted by the military can result in seafloor disturbance. Activities can include the following: live-fire testing and training; torpedo testing; weapons testing; live ordnance release and impact activities; live underwater ordnance detonation operations; mine neutralization operations; torpedo firing exercises; dynamic submarine, surface ship, and helicopter anti-submarine warfare exercises; anti-submarine warfare instrumented training on seabed; bomb dropping exercises; and mine warfare testing and training. Refer to Chapter 2.3.2 of the GOM Oil and Gas SID for more information associated with onshore and offshore activities that create bottom disturbance.

3.6.7 Noise

Noise in the ocean is the result of both natural and anthropogenic sources. Natural sources of noise include sounds produced by animals and processes such as wind-driven waves, rainfall, and storms. Human-generated (anthropogenic) contributions to the ocean's soundscape have steadily increased in the past several decades. This increase is largely driven by a worldwide increase in oil and gas exploration and the amount of vessel traffic using the GOM, including sources not related to OCS oil- and gas-related operations such as tourism, commercial shipping, naval operations (e.g., military sonars, communications, and explosions), fishing (e.g., pingers used in fisheries to prevent animals getting caught in nets), research (e.g., air-guns, sonars, telemetry, communication, and navigation), and other activities such as construction (e.g., pile driving) and recreational boating. Refer to Chapter 2.4.2 of the GOM Oil and Gas SID for more information on impact-producing factors linked to noise.

3.6.8 Coastal Land Use/Modification

Non-OCS oil- and gas-related activities causing coastal land use/modification include sea-level rise and subsidence, erosion, saltwater intrusion, dredging and navigation canals, coastal restoration programs, and tourism infrastructure. Some areas of the Gulf Coast have experienced higher local rates of sea-level rise than the global average (U.S. Global Change Research Program 2018). This, coupled with coastal subsidence, will likely increase the risks to and extent of impacts from storm surges (U.S. Global Change Research Program 2018). Erosion is a major contributor to land loss in the coastal zone. Saltwater intrusion is one of many factors that impact coastal environments by killing marsh grasses and contributing to coastal land loss. Such impacts can be natural, as when storm surge brings GOM water inland, or anthropogenic, as when navigation or pipeline canals allow tides to introduce high salinity water to interior marshes. Impacts from dredging and navigation channels include the displacement of wetlands by original channel excavation and disposal of the dredged material. Indirect cumulative land losses resulted from hydrologic modifications, saltwater intrusion, or bank erosion from vessel wakes (Wang 1988). However, the material from maintenance dredging can be used to rebuild affected areas. Coastal restoration programs seek to address many of the above-mentioned issues. BOEM's Marine Minerals Program partners with communities to address serious erosion along the Nation's coastal beaches, dunes, barrier islands, and wetlands. Erosion affects natural resources, energy, defense, public infrastructure, and tourism. To help address this problem, the Marine Minerals Program leases sand, gravel, and/or shell resources from Federal waters on the OCS for shore protection, beach nourishment, and wetlands restoration with vigorous safety and environmental oversight. Several other programs have been established for the conservation, protection, and preservation of coastal areas, including wetlands along the Gulf Coast. In particular, the Louisiana Coastal Master Plan

(Coastal Protection and Restoration Authority of Louisiana 2023) has been developed to achieve the State's comprehensive coastal restoration and risk reduction goals. Tourism infrastructure enables humans to spend time away from home in pursuit of recreation, leisure, and other endeavors. Counties and parishes along the Gulf of Mexico are home to various resources and infrastructure that support recreation and tourism. Publicly owned and administered areas (such as national seashores, parks, beaches, and wildlife lands), as well as specially designated preservation areas (such as historic and natural sites and landmarks, wilderness areas, wildlife sanctuaries, and scenic rivers), attract residents and visitors throughout the year. For more information on non-OCS oil- and gas-related activities in the Gulf of Mexico OCS refer to Chapter 2.5.2 of the GOM Oil and Gas SID.

Sea-Level Rise

The Intergovernmental Panel on Climate Change (IPCC) reported that, since 1961, global average sea level (mean sea level) has increased by 0.20 [0.15 to 0.25] m (0.65 [0.49-0.82] ft) between 1901 and 2018. The average rate of sea-level rise was 1.3 [0.6 to 2.1] mm yr^{-1} between 1901 and 1971, increasing to 1.9 [0.8 to 2.9] mm yr^{-1} between 1971 and 2006, and further increasing to 3.7 [3.2 to 4.2] mm yr^{-1} between 2006 and 2018 (high confidence). Human influence was very likely the main driver of these increases since at least 1971 (Intergovernmental Panel on Climate Change 2021).

Sweet et al. (2022) estimated sea-level rise scenarios and probabilities of water level at 1-degree grids along the U.S. coastline based on the United Nations Intergovernmental Panel on Climate Change (IPCC) Sixth Assessment Report (Intergovernmental Panel on Climate Change 2021). These two reports comprise key technical information and data for the Fifth National Climate Assessment (U.S. Global Change Research Program 2023), which is a comprehensive and integrative research program to assess the impact of climate change in the U.S. Combining historical observations and model projections, Sweet et al. (2022) reported with high confidence that relative sea level along the contiguous U.S. (CONUS) coastline is expected to rise on average as much over the next 30 years (0.25-0.30 m [0.82-0.98 ft] over 2020-2050) as it has over the last 100 years (1920-2020).

3.6.9 Lighting and Visual Impacts

There are many stakeholders that use the ocean environment in addition to the OCS Oil and Gas Program, including tourism and recreation, commercial and recreational fishing, marine transportation, subsea cables, military activities, deepwater ports, OCS sand borrowing, renewable energy turbines, ocean dumping, and in the near future, carbon sequestration. Each of these uses has the potential to alter or disrupt the existing visual and aesthetic environment. Lighting and visual impacts are covered in greater detail in Chapter 2.6 of the GOM Oil and Gas SID.

3.6.10 Offshore Habitat Modification/Space Use

In addition to the OCS Oil and Gas Program, other activities on the Gulf of Mexico OCS include tourism and recreation, commercial and recreational fishing, marine transportation, subsea cables, the military, deepwater ports, OCS sand borrowing, renewable energy development, ocean dumping, and aquaculture, and in the near future, carbon sequestration. Each of these uses for the Gulf of Mexico OCS requires some amount of space to operate and must be taken into account when planning to hold proposed OCS oil and gas lease sales that would potentially make areas of the Gulf of Mexico OCS unavailable for other uses (**Table 3.6-2**). Recreational activities can occur in large areas (i.e., beach going) but many occur in small, localized areas (i.e., offshore diving). Some recreational areas can be permanent uses of space (e.g., public beaches, wildlife areas, etc.) while others represent only a short-term use of space (e.g., boating, diving, etc.). Both commercial and recreational fishing are valuable industries that represent significant uses of the OCS. In areas of dense fishing effort, or where gear is spread over a large area, commercial fishing has the potential to cause semi-permanent, standoff-distance conflicts on the OCS. Most recreational fishing in the GOM planning areas takes place within State waters. However, for those few trips that do take place on the Federal OCS, they represent a short-term and localized use of the OCS.

Table 3.6-2. Areas of Marine Space Use by Industries Other Than Oil and Gas.

Industry	Coastal	Sea Surface/ Airspace	Water Column	Seafloor
Recreation	X	X	X	X
Commercial and Recreational Fishing	X	X	X	X
Ports, Navigation Lanes, and Shipping	X	X	X	-
Undersea Cables	-	X	-	X
Military	X	X	X	X
Deepwater Ports	-	X	X	X
OCS Sand Borrowing	-	X	-	X
Coastal Restoration	X	-	-	X
Renewable Energy	X	X	X	X
Ocean Dumping	-	-	-	X

Maritime shipping is one of the most important industries on the Gulf Coast. As such, there is a large existing infrastructure presence in the GOM to support the industry, including ports and navigation lanes. The maritime shipping industry represents a major use of GOM coastal space both for onshore infrastructure needs such as port facilities and for offshore needs such as safe navigation.

As discussed in Chapter 2.7.2.4 of the GOM Oil and Gas SID, there are currently only two major telecommunications subsea cable networks on the Gulf of Mexico OCS: one traversing the WPA and CPA with landing points in Freeport, Texas, and Pascagoula, Mississippi; and another crossing part of the EPA with a landing point in Sarasota, Florida. Gold Data, Inc. has also announced construction of a subsea cable (GD-1) with landfall points in Apalachee Bay, Florida, and Veracruz, Mexico, as part of a joint project with Liberty Networks (Gold Data 2023). The GD-1 cable is expected to be installed and operational in late 2026. Undersea cables are critical infrastructure for telecommunications or power transmission and represent an important use of the OCS. The space-use requirements for undersea cables are dependent on the requirements for the specific project and are typically determined on a case-by-case basis but may be large. TeleGeography maintains a comprehensive map of submarine cables at https://www.submarinecablemap.com/.

The U.S. Department of Defense conducts training, testing, and operations in offshore operating areas, military warning areas, at warfare training ranges, and in special use or restricted airspace on the OCS. These activities are critical to military readiness and national security. However, the offshore operating areas, military warning areas, and Eglin water test areas are multiple-use areas where military operations and oil and gas development have coexisted without conflict for many years through the use of Military Stipulations.

Deepwater ports are installations on the OCS that service the importing and exporting of natural gas products like liquefied natural gas and crude oil. These facilities represent permanent but localized use of the OCS and usually also connect to onshore infrastructure. While there is currently only the LOOP in the Gulf of Mexico, several additional deepwater ports have been proposed and are in the licensing and permitting process (refer to Chapter 2.7.2.6 of the GOM Oil and Gas SID).

Sand, gravel, and other mineral resources from the OCS are often used in beach nourishment, wetlands restoration, and other coastal restoration projects to address erosion issues. As the sole steward of OCS marine minerals, BOEM assesses where sand resources are located, how much may be available for coastal protection and restoration projects, and reserves these critical minerals. Given the substantial number of other ocean users, BOEM strives to reduce or eliminate the potential for multiple-use conflicts or environmental impacts that could result from marine minerals projects.

Renewable energy development has the future potential to utilize large areas of the GOM. BOEM organized a GOM Renewable Energy Task Force with State and other Federal stakeholders to address the multiple-use conflicts associated with renewable energy development. On August 29, 2023, BOEM held the first offshore wind energy auction for the Gulf of Mexico region, resulting in one lease area being issued to RWE Offshore US Gulf, which has the potential to generate approximately 1.24 gigawatts of offshore wind energy capacity. On March 19, 2024, BOEM issued a Proposed Sale Notice for a second auction to be held on September 24, 2024. At present, it is reasonably foreseeable for renewable energy site assessment and site characterization activities to take place on the Gulf of Mexico OCS. These activities represent only a small and short-term use of the OCS.

Ocean dumping uses space at the seafloor. Designated ocean disposal sites for dredged materials are selected to minimize the risk of potentially adverse impacts of the disposed material on human health and the marine environment. Permits for ocean dumping of dredged material are subject to USEPA review and written concurrence (USEPA 2020c).

Offshore aquaculture is the rearing of aquatic animals in controlled environments (e.g., cages or net pens) in Federal waters. In the GOM, marine aquaculture focuses on stock enhancement (i.e., the release of juvenile fishes to supplement wild populations), food production, research, and restoration efforts (NMFS 2020a). The NOAA is not currently issuing permits for aquaculture in

Federal waters of the Gulf of Mexico; however, NMFS has identified aquaculture opportunity areas in the GOM and is beginning the NEPA process to assess the impacts of these areas (NMFS 2023a).

3.6.11 Socioeconomic Changes and Drivers

This IPF broadly addresses the extent to which non-OCS oil- and gas-related activities produce socioeconomic changes. Because people plan for, instigate, avoid, and react to changes in myriad ways, socioeconomic considerations are also drivers of change in the offshore oil and gas industry and elsewhere in society, changes which, in turn, cause additional changes with their own impacts. These impacts are often interpreted subjectively and can be perceived as positive, negative, or neutral, often simultaneously, for multiple reasons or by multiple groups of people. Socioeconomic changes and drivers associated with variables like job loss and creation, public perceptions, etc. are discussed in Chapter 2.8 of the GOM Oil and Gas SID.

3.6.12 Natural Processes

Major Storms

From 2017 to 2022, several hurricanes and tropical storms crossed through the GOM or made landfall on coastal areas of the GOM. Oil and natural gas production was reduced for several days during Hurricanes Harvey, Nate, Michael, Barry, Laura, Sally, Delta, Zeta, and Ida, and Tropical Storms Gordon, Cindy, and Cristobal; however, damage to platforms and refineries from each hurricane or tropical storm appeared minimal (BSEE 2017a; 2017b; 2017c; 2018a; 2018b; 2019; 2020a; 2020b; 2020c; 2020d; 2020e; 2021). In August 2021, a pipeline and a wellhead on the seafloor were impacted by Hurricane Ida and resulted in accidental releases. Aerial images taken by NOAA showed an oil spill approximately two miles south of Port Fourchon, Louisiana, which was attributed to a ruptured pipeline and a spill discovered five miles from the Bay Marchand Port was attributed to a wellhead discharging oil (Powell 2021; USCG 2021). For additional detail on major storms affecting the GOM, refer to Chapter 3.3.1 of the GOM Oil and Gas SID.

Eutrophication and Hypoxia

Nutrients are substances that are essential to both plant and animal growth. Common nutrients include nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, silicon, and organic matter. While nutrients are an essential component to healthy ecosystems, excess amounts of nutrients added to water bodies (eutrophication) can create unintended side effects. These excess nutrients can cause an overproduction in the growth of aquatic primary producers (e.g., algae). The bacterial decomposition of this algae after it dies consumes dissolved oxygen, which causes low-oxygen conditions (hypoxia) in water where eutrophication happens.

The Gulf of Mexico hypoxic zone is a band of oxygen-stratified water that stretches along the Texas-Louisiana shelf each summer where the dissolved oxygen concentrations are less than 2 milligrams per liter (USEPA 2019). Other small hypoxic areas infrequently form at the discharge of smaller rivers along the Gulf Coast; however, in the Gulf of Mexico, the hypoxic zone resulting from the Mississippi and Atchafalaya Rivers is the largest such zone. The hypoxic zone is the result of excess nutrients (eutrophication; Chapter 3.3.2 of the GOM Oil and Gas SID), primarily nitrogen and phosphorus, carried downstream by rivers to discharge to coastal waters. Density stratification results where the less dense, nutrient-rich freshwater spreads on top of the denser seawater and prevents oxygen from replenishing the bottom waters. The excess nutrients cause phytoplankton (algae) blooms that eventually die and sink to the bottom, where the bacterial decomposition occurs. The oxygen-depleted bottom waters occur seasonally and are affected by the timing of the Mississippi and Atchafalaya Rivers' discharges carrying nutrients and fresh water to shelf surface waters. Hypoxic zones are sometimes called "dead zones" because of the absence of commercial quantities of shrimp and fishes in the bottom layer.

The 2023 area of low oxygen that forms annually in the Gulf of Mexico was seventh smallest on record since the data collection initiative started 37 years ago. In 2023, the area was measured as 3,058 mi^2 (7,920 km^2), which was smaller than the forecasted size of 4,155 mi^2 (10,761 km^2) (Wittkofsky 2023).

Natural Seeps

Natural petroleum seeps, in which crude oil and gas naturally migrate up through the seafloor and into the water column, are very common in the Gulf of Mexico and are the second highest input of petroleum after land-based sources (National Academies of Sciences, Engineering, and Medicine 2022a). Gulf of Mexico seeps are highly variable in composition and volume and include gases, volatiles, liquids, pitch, asphalt, tars, water, brines, and fluidized sediments. Seeps are most abundant and most prolific in the central and western regions of the northern GOM (Garcia-Pineda et al. 2010). For additional detail on natural seeps, refer to Chapter 3.3.3 of the GOM Oil and Gas SID.

CHAPTER 4

AFFECTED ENVIRONMENT
AND ENVIRONMENTAL CONSEQUENCES

4 AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

4.0 OVERVIEW

This Programmatic EIS contains analyses of the potential environmental impacts that could result under Alternatives A-D from a single representative proposed OCS oil and gas lease sale in the GOM. These analyses may be applied, supplemented, or both as appropriate to inform the decisions for potential future OCS oil and gas lease sales in the GOM, as scheduled in a National OCS Oil and Gas Program. The impact analyses from the GOM Oil and Gas Programmatic EIS will also be used for tiering purposes for associated site- and activity-specific OCS oil- and gas-related activity approvals, and to inform extraordinary circumstance reviews to ensure categorical exclusions are used appropriately.

This Programmatic EIS incorporates by reference the GOM Oil and Gas SID. This document provides a robust characterization of the affected environment and environmental setting; a description of the activities associated with oil and gas operations in the GOM and other activities and environmental factors not associated with OCS oil and gas activities; and a description of the cause and effect relationships leading to the potential range of effects to the physical, biological, and human environments. Consistent with 40 CFR § 1501.9 (as of February 23, 2024), this preliminary identification and disclosure of the potential range of effects and their influencing variables was used to scope out unimportant issues and focus the analyses in this Programmatic EIS on the potentially important issues. BOEM's subject-matter experts incorporated the GOM Oil and Gas SID and other information acquired during internal and external scoping and then applied the scenarios presented in **Chapter 3** to evaluate the context and intensity of potential impacts. They were then able to determine what the overall level of direct, indirect, and cumulative impacts would be for Alternatives A-D. The following resource categories are included in this chapter: air quality; water quality; coastal communities and habitats (including wetlands, seagrasses/submerged aquatic vegetation, and barrier beaches and associated dunes); benthic communities and habitats (including topographic features, pinnacle trends, and protected corals); pelagic communities and habitats (including *Sargassum*); fishes and invertebrates; birds; marine mammals; sea turtles; commercial fisheries; recreational fishing; recreational resources; cultural, historical, and archaeological resources; land use and coastal infrastructure; economic factors; and socioeconomic factors (including environmental justice).

4.0.1 Environmental Setting

This chapter provides a regional overview of the geological, meteorological, physical, pelagic, benthic, coastal, and human environmental characteristics of the GOM. It also describes various regional-scale natural events and processes. The summaries of the environmental setting below are incorporated by reference from Chapter 3 of the GOM Oil and Gas SID and Chapter 2.8 of the 2024-2029 National OCS Oil and Gas Program Programmatic EIS. These descriptions form the baseline environmental conditions in which the Proposed Action is evaluated. Past and ongoing OCS oil- and gas-related activities (evaluated in previous BOEM environmental analyses) contributed to the existing baseline environmental conditions as well as non-OCS oil- and gas-related activities.

4.0.1.1 Geologic Environment

The present-day GOM is a small ocean basin with a water-surface area of more than 1.5 million square kilometers (km^2; 371 million acres). The greatest water depth is approximately 3,700 m (roughly 12,000 ft). It is almost completely surrounded by land, opening to the Atlantic Ocean through the Straits of Florida and to the Caribbean Sea through the Yucatan Channel. Although the smallest by area, the GOM is currently the most important region for U.S. offshore energy production. There are two major sedimentary provinces in the Gulf Coast region: Cenozoic (the western and central part of the GOM) and Mesozoic (the eastern GOM). The plays of the Cenozoic Province extend from offshore Texas eastward across the north-central GOM to the edge of the Cretaceous Shelf Edge (commonly known as the Florida Escarpment) offshore Mississippi, Alabama, and Florida. It incorporates the entire WPA, a large portion of the CPA, and the southwestern portion of the EPA. To date, all of the hydrocarbon production on the OCS in the Cenozoic Province is from sands ranging in age from Paleocene to Pleistocene (approximately 62-0.1 million years ago). The Mesozoic Province in the OCS extends eastward from the Cretaceous Shelf Edge off the coast of Mississippi, Alabama, and Florida towards the coastline of Florida. Most of this area has experienced limited drilling, mainly on the shelf, with some production from the Mesozoic Norphlet in the CPA. The seafloor of the northern GOM has hundreds of salt domes, which are areas where salt has risen upward into overlying sediments to create dome-like structures. These salt domes are important features that are linked to oil and gas reservoirs, as well as the formation of brine pools and other hydrocarbon seeps, found throughout the region. More detail on the assessment units, geologic plays, and geologic setting of the GOM can be found in the *2021 Assessment of Technically and Economically Recoverable Oil and Natural Gas Resources of the Gulf of Mexico Outer Continental Shelf* (BOEM 2021a).

Natural petroleum seeps, in which crude oil and gas naturally migrate up through the seafloor and into the water column, are very common in the GOM and have likely been active throughout history. Gulf of Mexico seeps are highly variable in composition and volume and include gases, volatiles, liquids, pitch, asphalt, tars, water, brines, and fluidized sediments. Seeps are most abundant and most prolific in the central and western regions of the northern GOM (Garcia-Pineda et al. 2010). Natural hydrocarbon seeps may contribute 95 percent to the total oil inputs (i.e., the combination of natural and anthropogenic sources) to the GOM (Kvenvolden and Cooper 2003; MacDonald et al. 2015; National Research Council 2003b).

4.0.1.2 Meteorological Environment

The GOM is influenced by a maritime subtropical climate controlled mainly by the clockwise circulation around the semi-permanent area of high barometric pressure commonly known as the Bermuda High. This proximity to the high-pressure system results in a predominantly southeasterly wind flow in the GOM region. The relative humidity over the GOM is high throughout the year. Precipitation is frequent and abundant throughout the year but does show distinct seasonal variation. The average monthly pressure shows a west to east gradient along the northern GOM during the summer. In the winter, the monthly pressure is more uniform along the northern GOM. Air temperature ranges from highs in the summer of 24.7-28.0°C (76.5-82.4°F) to lows in the winter of 2.1-21.7°C (35.8-71.1°F). Air temperatures over the open GOM exhibit narrower limits of variations on a daily and seasonal basis due to the moderating effect of the large bodies of water. Ambient air quality monitoring shows that onshore criteria air pollutant (CAP) levels along the Gulf Coast are below the National Ambient Air Quality Standards (NAAQS), except for the Houston-Galveston-Brazoria nonattainment area for O_3 and the St. Bernard nonattainment area for SO_2 (refer to Figure 4.1.1-1 of the GOM Oil and Gas SID).

Hurricanes often develop in or migrate into the GOM during the warmer months. Tropical cyclones (especially hurricanes) affecting the Gulf of Mexico originate over the equatorial portions of the Atlantic Ocean, Caribbean Sea, and GOM. Tropical cyclones occur most frequently between June and November. Based on 50 years of data, there are about 10.2 storms per year with about 5.9 of those becoming hurricanes in the Atlantic Ocean. Data from 1950 to 2000 show that 81 percent of these storms could affect the GOM (Klotzbach et al. 2020). There is a high probability that tropical storms would cause damage to physical, economic, biological, and social systems (including OCS oil- and gas-related activities) in the Gulf of Mexico. Most of the damage is caused by storm surge, waves, and high winds. Storm surge depends on local factors, such as bottom topography and coastline configuration, and storm intensity. Water depth and storm intensity control wave height during hurricane conditions. Sustained winds for major hurricanes (Saffir-Simpson Category 3 and above) are higher than 95.2 kn (109.6 mph). There were 24 major hurricanes (Category 3 or higher at landfall) that impacted the Gulf Coast from 2000 through 2023. These types of storms may affect any area of the GOM and substantially alter the local wind circulation around them.

4.0.1.3 Physical Environment

The Loop Current is the dominant circulation feature in the GOM. Warm water originating in the Atlantic Ocean flows through the Caribbean and northward past the Yucatan peninsula into the GOM. This flow “loops” around the GOM and exits near the Florida Straits to join the Gulf Stream. Loop Current rings (which are seasonal warm-water eddies) separate from the Loop Current and flow in an anticyclonic (or clockwise) pattern in the western GOM. At times, the boundary of the Loop Current sheds smaller, cold-core, cyclonic eddies (Sturges and Leben 2000). Dynamics of the Loop Current and eddies have an important influence on levels of primary productivity in the GOM region. Circulation on the continental shelf in the northeastern GOM has been observed to follow a cyclonic pattern, with westward alongshore currents prevailing on the inner and middle shelf and opposing alongshore flow over the outer shelf and slope (Brooks and Giammona 1991). The outer shelf is an area of transition between deepwater currents over the continental slope and the shelf regime. Cold water from deeper off-shelf regions moves onto and off of the continental shelf by cross-shelf flow associated with upwelling and downwelling processes. Mean deep (~2,000 m [~6,562 ft]) flow around the edges of the GOM circulates in a cyclonic (counterclockwise) direction (Sturges et al. 2004). A net counterclockwise circulation pattern was also observed at about 900-m (2,953-ft) depth around the borders of the GOM (Weatherly 2004). In deep water, several oil and gas operators have observed short-term (up to a day), very high-speed currents (150 cm/s [59 in/s]) in the upper portions of the water column. Such currents may have vertical extents of less than 100 m (328 ft), and they generally occur within the depth range of 100-300 m (328-984 ft) in total water depths of 700 m (2,297 ft) or less over the upper continental slope.

Cold fronts, as well as diurnal and seasonal cycles of heat flux at the air/sea interface, affect near-surface water temperatures. However, water at depths greater than about 100 m (328 ft) remains unaffected by surface boundary heat flux. Watermass property extremes are closely associated with specific density surfaces. Summer heating and stratification affect continental-shelf waters in the GOM. Salinity is generally lower nearshore, although fresh water from the Mississippi River and other rivers occasionally moves into outer shelf waters. Freshwater intrusions further lower the salinity after local storms. Subsurface waters derive from outside the Gulf of Mexico and enter from the Caribbean Sea through the Yucatan Channel. Below about 1,800 m (5,906 ft), temperature and salinity across the GOM is relatively uniform (Nowlin Jr. 1972). As average water temperatures rise, tropical corals have been observed shifting from the Caribbean to the GOM (Precht and Aronson 2004). In the northern GOM, fishes and invertebrates have displayed an overall trend of moving into deeper water between 1968 and 2011 (Pinsky et al. 2013). Invasive lionfish, first observed in the northern GOM in 2010, have grown exponentially in number and are commonly found on reefs competing with or preying upon native GOM fish species like vermilion snapper (Dahl and Patterson III 2014).

4.0.1.4 Pelagic Environment

Water quality in the GOM region is generally rated as fair (USEPA 2012). River water flowing into marine waters is a primary influence on water quality within the GOM region and includes input from 33 major rivers (including the Mississippi River) that drain 31 states (Ellis and Dean 2012). These discharges produce a cross-shelf pattern in biological productivity, with the highest productivity occurring along the coasts and gradually declining with distance from shore (Karnauskas et al. 2013). Additional influences on water quality include point-source discharges, marine traffic, oil and gas production and development, natural events, and atmospheric deposition. Agricultural runoff from fertilizer and pesticide use introduces additional nutrient-rich water into the GOM. While nutrients are an essential component to healthy ecosystems, excess amounts of nutrients added to waterbodies (called “eutrophication”) can create unintended side effects. The combined naturally nutrient rich waters of the GOM with anthropogenic inputs can support large seasonal algal blooms (including harmful algal blooms). The decomposition of these large algal blooms may lead to hypoxia (low or depleted areas of oxygen) on the continental shelf of the northern GOM (Obenour et al. 2013; Rabalais et al. 2002; Turner et al. 2012).

Pelagic communities include larvae from a wide variety of fishes and invertebrate species, which provide important food resources for larger animals (Biggs and Ressler 2001; Cardona et al. 2016; Muller-Karger et al. 2015). The composition of pelagic fishes varies from the inner shelf (e.g., seatrout and cobia), to middle shelf (e.g., snappers and jacks), and to deep waters (e.g., tunas and mesopelagic fishes like lanternfish and bristlemouths) (Biggs and Ressler 2001; Ditty et al. 1988; Muhling et al. 2012) and supports many large-scale commercial and recreational fisheries. The Flower Garden Banks National Marine Sanctuary (FGBNMS) in the northern GOM is an important habitat for many species of fishes and invertebrates. Brown algae *Sargassum* is an important feature of GOM pelagic waters; it can cover widespread areas and form floating mats large enough to be detectable by satellite (Hardy et al. 2018; Hu et al. 2016). *Sargassum* mats also provide food and protection from predation for a wide spectrum of fauna, including larval and juvenile fishes and sea turtles (Casazza and Ross 2008; Dooley 1972). Common pelagic birds include shearwaters, storm-petrels, boobies, northern gannets, jaegers, phalaropes, petrels, gulls, and terns (Duncan and Havard 1980). Five species of ESA-listed sea turtles occur in the GOM planning areas: loggerhead; green; hawksbill; Kemp's ridley; and leatherback (NOAA 2015). All these species rely on coastal and pelagic waters for foraging needs (Bjorndal 1997; Collard 1990; Davis and Fargion 1996; Fritts et al. 1983a, 1983b; Godley et al. 2008; NMFS and FWS 2015). Twenty-one species of marine mammals regularly occur in the GOM pelagic environment including a unique evolutionary lineage of baleen whale (Rice's whale, previously known as the GOM subpopulation of Bryde's whale) and 20 species of toothed whales and dolphins. Both the Rice's and sperm whales are ESA-listed and have presumed year-round resident populations in the GOM (NMFS 2020b; Van Parijs 2015). The *Deepwater Horizon* oil spill had lasting effects on the pelagic food web and throughout the water column in the GOM (Fisher et al. 2016; Pulster et al. 2020), with chronic exposure to hydrocarbons affecting populations years after the spill. In addition, large numbers of fish eggs and larvae were killed or potentially impaired, which may have lasting effects on species' demographics and pelagic food webs (Deepwater Horizon Natural Resource Damage Assessment Trustees 2016).

4.0.1.5 Benthic Environment

The seafloor of the GOM region is composed primarily of muddy and sandy sediments. The sediments of the GOM are deposited mostly in deltaic environments of sands and shales, usually deposited as channel or delta front sands on the shelf. The nearly ubiquitous soft bottom environments in the GOM are home to demersal fishes and marine benthic communities, which include invertebrates like sea stars, crabs, and worms (Rowe and Kennicutt II 2009). The shelf area holds the potential for deepwater delta systems with channels, distributary bars, levees, overbank deposits, and large fan lobes in the older and deeper section. Nearshore and shelf habitat may serve as EFH for managed species like shrimp, stone crab, and spiny lobster (Gulf of Mexico Fishery Management Council 2005). Hard bottom habitats, though far less common than soft bottom environments, are scattered across the GOM. These habitats include shallow and deepwater coral reefs, pinnacles, banks, and artificial reefs. The coral reefs of the GOM provide important habitat for many species of invertebrates and fishes, including commercially and recreationally important species of snapper and grouper, for which these areas have been designated essential fish habitat. Many HAPCs in the GOM are based on the presence of living coral reefs or hard bottoms, including ESA-listed species such as elkhorn and staghorn coral. Coral EFH includes hard bottom areas on the scattered pinnacles in the CPA and EPA, and banks in the CPA (16 features) and WPA (21 features) (Gulf of Mexico Fishery Management Council 2016). Submerged banks in the WPA and CPA are isolated areas of higher relief that provide hard bottom habitat for communities of high biomass and diversity. The WPA and CPA contain the FGBNMS, a system of banks atop salt dome formations. These banks, including those added in the recent expansion, are biodiversity hotspots that provide important habitat and represent key examples of coral and algal reefs and mesophotic and deepwater coral communities in the GOM (NOAA 2020). The topography of the continental slope is irregular and characterized by canyons, troughs, and salt structures. Several major submarine canyons, such as Mississippi and DeSoto Canyons, serve as important feeding areas for predators. The abyssal plains (ocean floor) are basically horizontal physiographic subprovinces and are surrounded by features with higher topography. The GOM also contains deepwater coral communities that have been found as deep as 9,842 ft (3,000 m) (BOEM 2012; Brooks et al. 2012).

At least 330 chemosynthetic communities exist in the GOM (BOEM 2016). Deep-sea sponges, corals, and tubeworms are attracted to these chemosynthetic communities and associated substrates and then, in turn, attract relatively large numbers and species of invertebrates and fishes to these microhabitats for shelter, feeding, and nursery grounds (BOEM 2017; Fraser and Sedberry 2008). Gas hydrates are a naturally occurring “ice-like” combination of natural gas and water (gas trapped in ice crystals) that have the potential to be a significant new source of energy from the world’s oceans and polar regions. Hydrates have been observed and sampled from the Gulf of Mexico OCS in association with naturally occurring oil and gas seeps in localized deepwater areas of very cold temperature and high pressure at or near the seafloor.

4.0.1.6 Coastal Environment

The U.S. coastline in the GOM comprises more than 750 bays, estuaries, and sub-estuary systems (USEPA 2012). These coastal and estuarine habitats provide important nursery grounds and adult habitat for numerous species of fishes and invertebrates, while seagrass beds provide foraging habitat for sea turtles and manatees (Byrnes et al. 2017). Gulf of Mexico coastal waters support stocks of several commercially and recreationally valuable fishes and invertebrate species that are managed by NOAA and the Gulf of Mexico Fishery Management Council. The most common coastal habitats in the GOM include saltwater marshes, saltwater mangrove swamps, and non-vegetated areas such as sandbars, mudflats, and shoals (Dahl and Stedman 2013; Gulf Restoration Network 2004). Barrier islands are present on more than half of the U.S. Gulf of Mexico coastline (BOEM 2015; Dolan and Lins 1987) and protect the mainland from shoreline erosion by reducing wave action (Rosati 2009; Zinnert et al. 2019). Barrier islands also provide habitat for many species of birds, sea turtles, and sand-dwelling crustaceans. Submerged aquatic vegetation is a vital component of coastal aquatic ecosystems, with at least 26 species of seagrasses and attached macroalgae growing in the northern GOM (Carter et al. 2011; Cosentino-Manning et al. 2015; Heck et al. 2011). Seagrasses serve important ecological functions, including foraging material for grazers, habitat for marine life, and important nursery grounds for numerous commercially important fish and invertebrate species.

4.0.1.7 Human Environment

Communities in the GOM region depend on the ocean economy for employment and income. In 2019, over 616,000 people were employed in coastal industries (2.8% of total employment in the region), bringing in $115 billion dollars in gross domestic product (GDP) (4.3% of total GDP in the region). The GOM’s ocean economy is heavily influenced by the recreation and tourism industry, which provides for over half of the jobs in this sector, and offshore oil and gas activities, which generate 70 percent of the GDP (NOAA 2021; 2022). The GOM contributes the highest percentage of GDP in the entire U.S. ocean economy, with Texas contributing a majority of that percentage due to the offshore oil and gas industry (NOAA 2019). The GDP in the GOM ocean economy increased by 41 percent from 2009 to 2019, driven by changes in resource pricing (NOAA 2021). The oil and gas industry sector as a whole has been operating for decades and plays a central role in the employment base for the WPA and CPA (Louisiana State University 2017). In contrast, the EPA has few active leases off Florida's Gulf Coast.

The GOM is home to some of the world's most productive commercial and recreational fisheries. The region accounts for approximately 20 percent of the total domestic commercial and recreational harvest (landings) each year, sustaining the livelihoods of thousands of fishermen and their families, and providing a way of life for coastal communities. Shrimp, menhaden, oysters, and blue crab are some of the GOM's most important commercial species.

The GOM coastal zone provides significant ecological and economic value to the region and holds important archaeological and cultural resources. Shipwrecks are scattered throughout the GOM at all water depths. During oil and gas exploration, many shipwrecks have been discovered and listed in the National Register of Historic Places. The GOM coastline contains archaeological, cultural, and historic sites, many of which are listed in the National Register of Historic Places.

Land use in coastal areas of the GOM is a mix of urban, industrial, and rural activities, including manufacturing, shipping, agriculture, and recreation. The Gulf Coast, particularly in the WPA and CPA, is known for an established offshore oil and gas industry with a network of related onshore support industries. Other important Gulf Coast industries include commercial shipping, fisheries, tourism, and hospitality (i.e., hotels and restaurants). More than half of the 20 largest U.S. ports are along the Gulf Coast, mostly along the WPA and CPA (Industrial Economics Inc. 2014). The Gulf Coast has numerous State parks, beaches, and important environmental features that support multiple uses, including commercial and recreational fisheries and recreation and tourism. Parts of the GOM's sandy seafloor support marine mineral dredging on the OCS to address erosion along beaches and to strengthen the resilience of coastal communities and infrastructure.

The culture of the GOM region varies greatly, from Houston, Texas, the fourth most populous city in the U.S., to smaller metropolitan areas (e.g., Corpus Christi and Galveston, Texas; New Orleans, Louisiana; Mobile, Alabama; and Tampa, Florida), and to Louisiana's largely undeveloped bayous, inhabited by Indigenous and Cajun communities. Culture is also strongly tied to commercial and recreational fisheries, the oil and gas industry, recreation and tourism (fueled by beaches, especially on the Alabama and Florida Gulf Coasts, and vibrant tourist destinations, such as Key West, Florida, and New Orleans, Louisiana), and the socioeconomic impacts of these industries. In 2018, coastal recreation and tourism in the GOM region contributed 13 percent of the GDP and made up 58 percent of employment in the ocean economy sector, making this industry the largest employment sector for the region's ocean-based economy (NOAA 2019).

Vulnerable coastal communities in the WPA and CPA face historic, ongoing, and potential future burdens resulting from a combination of land use and industrial development patterns, land loss and sea-level rise, and changes in storm frequency and intensity. Disparities in health outcomes for low-income and minority communities near oil and gas processing and petrochemical facilities have also been discussed in several areas of the GOM region, including communities in Louisiana and Texas (Fleischman and Franklin 2017; Johnston and Cushing 2020; Terrell and St. Julien 2023). For more detail on vulnerable coastal communities, many of which also qualify as environmental justice populations, refer to **Chapter 4.16**.

4.0.2 Issues of Programmatic Concern

4.0.2.1 Greenhouse Gas Emissions

BOEM updated its analysis of life cycle greenhouse gas (GHG) emissions with publication of the 2024-2029 National OCS Oil and Gas Program. The analysis includes a newly developed quantitative estimate of a proposed action's impact on foreign oil production and the resulting increase of GHG emissions. The analysis for this Draft PEIS builds on what was done in the National OCS Program by considering the impacts from a single representative GOM oil and gas lease sale. Importantly, while the location of the forecasted activities could shift under any of the three action alternatives (i.e., Alternatives B, C and D), the ranges in overall production and activity levels do not change. As discussed in **Chapter 3.3.1**, these production and activity levels do not change because the majority of oil and gas resources in the Gulf of Mexico are located within the boundaries of all the action alternatives (B-D). As discussed in **Chapter 2.2**, BOEM's range of alternatives for a proposed OCS oil and gas lease sale reduced geographic areas by excluding targeted areas. These exclusions focus future OCS leasing in areas of known or expected interest while addressing environmental concerns, reducing marine spatial planning conflicts, and satisfying Inflation Reduction Act requirements needed to issue offshore wind energy leases. Therefore, the modelled GHG emissions are applicable to any action alternative.

This chapter provides an overview of BOEM's life cycle GHG emission estimates. The full analysis is included in **Appendix H**. "Life cycle" refers to emissions from all activities related to the upstream (exploration, development, and production), midstream (storage, refining, and transportation), and downstream (consumption) of a resource. Given the global nature of energy, in particular oil, BOEM includes both domestic and foreign GHG emissions in the analysis to the extent possible to capture both the emissions associated with OCS production as well as the resulting emissions associated with the impact that OCS production has on other domestic energy production and foreign oil production. The quantitative GHG emissions analysis can be categorized into two components: (1) the full life cycle GHG emissions estimates of domestically produced or consumed energy; and (2) the GHG emissions estimates of foreign oil production (upstream) and consumption (downstream). The potential general effects from climate change to the environment, as an IPF, are discussed in the specific resource sections later in this chapter.

BOEM's greenhouse gas analysis considers a No Action Alternative in which there is no new OCS leasing. Because there is no new leasing in the No Action Alternative, there are no associated GHG emissions assigned to the No Action Alternative as they are considered the baseline level of emissions (refer to **Chapter H.2.1** for more detail). OCS oil and gas production and associated GHG emissions from existing leases would still occur in the absence of the proposed action, but because these activities and emissions would occur regardless of future leasing decisions, they are not quantified. They are treated as part of the modeling baseline along with all other sources of energy not directly stemming from a new OCS lease sale. To the extent existing leases' production or other energy sources are displaced by the proposed action's production, BOEM accounts for the emissions reductions within its estimate of the total proposed action emissions. Total proposed action emissions are those associated with OCS exploration, development, and production from a lease sale under the proposed action after accounting for those emissions displaced from substitute energy sources which are not produced or consumed under the proposed action.

The total proposed action GHG emissions are the emissions from new OCS oil and natural gas activity and production as described in the analyzed exploration and development scenarios (**Chapter 3.3**). This also includes the reduction in GHG emissions based on displaced substitute energy sources such as coal, biofuel, renewables, and onshore or imported oil and natural gas displaced by the modeled OCS oil and gas production under the proposed action. When considering the full life cycle of energy produced or consumed domestically, BOEM's analysis indicates that the proposed action GHG emissions estimates are similar to those of displaced energy substitutes, and small changes in modeling assumptions could lead to different results. The total proposed action emissions range from 417 thousand metric tons CO_2 equivalent (CO_2e) below and 4.8 million metric tons CO_2e above the No Action Alternative GHG modeling baseline (**Appendix H**).

BOEM's analysis also considers GHG emission estimates resulting from a change in foreign oil production and consumption. If the proposed action is selected, BOEM estimates foreign oil consumption would increase by 168 million barrels over the period of proposed action production described in the high activity level E&D scenario. This is due to the decrease in prices caused due to an increase in supply from anticipated OCS oil and natural gas production under the proposed action.

Table 4.0-1 shows the estimates of life cycle GHG emissions from OCS oil and natural gas anticipated from new leases under the proposed action and those of domestically consumed or produced energy that would be displaced by the anticipated OCS oil and natural gas. **Table 4.0-1** also shows the change in GHG emissions associated with foreign oil production (upstream) and consumption (downstream) estimated to occur due to a decrease in oil prices under the proposed action. While BOEM provides estimates of GHG emissions resulting from a shift in foreign oil production and consumption, BOEM is not able to quantify the change in the global full life cycle GHG emissions resulting from the proposed action. BOEM provides a qualitative discussion of the unquantified components of global GHG emissions, i.e., those resulting from foreign oil's midstream and the full life cycle of foreign displaced non-oil energy substitutes (**Appendix H.4**).

Table 4.0-1 shows that BOEM estimates about 4.9 million metric tons of carbon dioxide equivalent (CO_2e) would be emitted from upstream OCS oil- and gas-related activities for the proposed action at the high activity level. However, because of the OCS production, other energy sources would not be produced (i.e., displaced). These displaced sources would have generated 38.6 million metric tons of CO_2e upstream emissions. The displaced energy substitutes, primarily oil imports and domestic onshore oil and gas, have higher upstream GHG emissions per barrel of oil equivalent than OCS oil and gas. This leads to reductions in total proposed action emissions for the domestic upstream at all activity levels.

Table 4.0-1. Life Cycle GHG Emissions of the Proposed Action in Thousands of Metric Tons CO_2e.

Activity Level	Source	Domestic Upstream	Domestic Mid- & Downstream	Domestic Total	Foreign Oil Upstream	Foreign Oil Downstream
Low	OCS Oil & Gas Emissions	124	22,192	22,315	562	4,310
Low	Displaced Energy Emissions	-2,880	-19,853	-22,732	**	**
Low	Total Proposed Action Emissions*	-2,756	2,339	-417	562	4,310
Mid	OCS Oil & Gas Emissions	1,651	126,439	128,090	3,487	26,739
Mid	Displaced Energy Emissions	-16,580	-111,916	-128,496	**	**
Mid	Total Proposed Action Emissions*	-14,928	14,522	-406	3,487	26,739
High	OCS Oil & Gas Emissions	4,927	300,173	305,100	8,295	63,587
High	Displaced Energy Emissions	-38,603	-261,673	-300,276	**	**
High	Total Proposed Action Emissions*	-33,676	38,500	4,824	8,295	63,587

Notes: Values rounded to nearest 1,000 metric tons.
For ease of comparison, BOEM provides combined totals of all three GHG emissions in CO_2 equivalent (CO_2e). CH_4 and N_2O are converted to CO_2e using USEPA current Global Warming Potentials (USEPA 2023c).
* The Total Proposed Action Emissions are the emissions associated with the OCS oil and gas plus the reductions associated with displaced energy substitutes. These emissions represent total GHG emissions attributable to the proposed action, i.e., row 1 plus row 2 (for each activity level).
** BOEM is unable to quantitatively estimate energy substitutes in foreign markets. Thus, there are no estimates of displaced energy substitutes within the columns for the foreign GHG emissions estimates.

For the midstream and downstream, the proposed action high-activity level emissions are estimated at 300.2 million metric tons of CO_2e. However, the emissions reductions from the displacement of energy substitutes are estimated at 261.7 million metric tons of CO_2e. This results in total proposed action midstream and downstream GHG emissions of 38.5 million metric tons of CO_2e. The proposed action mid- and downstream GHG emissions are larger than those of the displaced substitutes at all activity levels. This increase is due to the slightly higher energy consumption and fuel switching towards oil and natural gas influenced by lower oil and natural gas prices as a result of the anticipated OCS oil and natural gas production from new leases under the proposed action.

In total, the life cycle analysis of domestically produced or consumed energy shows that selection of the proposed action results in only small changes in emissions from those under the No Action Alternative. For the low and mid-activity levels, the total proposed action emissions represent a slight decrease in emissions. However, at the high activity level, the proposed action results in a small increase in GHG emissions above the No Action Alternative baseline level of emissions. The domestic analysis indicates that the proposed action emissions are similar to those resulting from the displaced substitutes. When considering the impact of changes in foreign oil production and consumption, the proposed action represents an increase in global GHG emissions. BOEM quantitatively estimates the change in foreign oil's upstream and downstream GHG emissions as a result of lower global oil prices under the proposed action. **Table 4.0-1** shows BOEM's estimates of the increase in foreign oil upstream GHG emissions under the proposed action[2] as well as the increase in GHG emissions from foreign oil consumption[3]. BOEM qualitatively considers shifts in the broader foreign energy market that are currently unable to be quantified. Like the impact on foreign oil's downstream, the foreign oil midstream would likely see an increase in GHG emissions. While foreign energy markets would see a decrease in GHG emissions due to increased oil consumption displacing substitute fossil fuel sources (e.g., natural gas and coal), that decrease would not mitigate the quantified increase in foreign oil's upstream and downstream emissions.

The CEQ published interim guidance in 88 FR 1196, effective January 9, 2023, directing agencies to "apply the best available estimates of the SC-GHG to the incremental metric tons of each individual type of GHG emissions expected from a proposed action and its alternatives." On December 22, 2023, the IWG published a memo suggesting that "agencies should use their professional judgment to determine which estimates of the SC-GHG reflect the best available evidence, are most appropriate for particular analytical contexts, and best facilitate sound decision-making" (Interagency Working Group on Social Cost of Greenhouse Gases 2023). In 2023, the USEPA published updated estimates monetizing the damages (and benefits) of climate change associated with an incremental change in GHG emissions in a given year (USEPA 2023j). These updated SC-GHG values by the USEPA represent the most comprehensive SC-GHG estimates and reflect the best available science. BOEM applies the USEPA's estimates to the annual estimates of GHG emissions and discounts them back to their net present value in 2024 dollars.

Table 4.0-2 provides estimates of the total proposed action's social costs of GHG emissions from domestically produced or consumed energy. The estimates show the social costs of GHG emissions estimates are very close to the baseline level of costs associated with the No Action Alternative. In all but one case, the Proposed Action results in an increase of total social costs that are higher (from 0.3% to 4.1%) relative to the substitute energy sources displaced by estimated OCS oil and natural gas production under the Proposed Action. When social costs from increased GHG emissions due to shifts in foreign oil's upstream and downstream are considered, the proposed action is estimated to result in higher global social costs than the No Action Alternative at all activity levels and SC-GHG discount rates. The domestic SC-GHG results are discussed in greater detail in **Appendix H**, which provides BOEM's social cost methodology and the foreign SC-GHG estimates. **Appendix H** also provides additional context for GHG emissions in terms of national climate and GHG reduction goals (as directed by the CEQ's guidance).

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[2] Foreign oil production actually decreases under the proposed action. However, BOEM's domestic analysis accounts for a reduced upstream (production) GHG emissions from a decrease in oil imports consumed domestically. To avoid double counting when taking a global perspective, BOEM adjusts the foreign oil upstream GHG emissions by the amount already accounted for domestically. Refer to **Appendix H.2.5.1** for a more detailed discussion of this adjustment.

[3] To avoid double counting when taking a global perspective, the increase in foreign oil consumption is adjusted to account for exports of OCS oil consumed abroad and already included in the domestic downstream GHG emissions analysis. Refer to **Appendix H.2.5.2** for a more detailed discussion of this adjustment.

Table 4.0-2. Total Proposed Action Social Costs* of GHG Emissions from Full Life Cycle of Domestically Produced or Consumed Energy (millions of 2024 dollars).

SC-GHG Source	Discount Rate	Low Activity Level	Mid-Activity Level	High Activity Level
USEPA	2.5%	-7	207	1,260
USEPA	2.0%	15	496	2,448
USEPA	1.5%	63	1,072	4,749

Notes: Values are rounded to nearest million dollars. Positive values represent costs while negative values represent benefits.

* Total proposed action social costs are the social costs associated with the OCS oil and gas GHG emissions plus the reductions in social costs associated with displaced energy substitutes GHG emissions. These are the total social costs of GHG emissions from domestically produced or consumed energy attributable to the proposed action.

In conclusion, global GHG emissions and their social costs would increase under the proposed action. BOEM is not providing a combined quantitative estimate of domestic and foreign emissions and their social costs, because BOEM's foreign GHG analysis is not quantified to the same extent as the domestic GHG analysis, relying on qualitative assessments to fill quantitative gaps. However, as explained in **Appendix H**, were BOEM able to quantify the missing components of the foreign GHG analysis, such estimates would not be expected to change BOEM's conclusions regarding the relative impact differences between the proposed action and alternatives. BOEM's combined quantitative and qualitative GHG analyses represent the best available and scientifically credible approach for evaluating and comparing impacts to climate change under the proposed action and the No Action Alternative (Alternative A). BOEM has used the best available scientific information to date and reasonably accepted scientific methodologies to extrapolate from existing information. The incomplete or unavailable information above, while relevant, would not likely change the impact conclusions reached in this analysis and is not essential to a reasoned choice among alternatives.

4.0.2.2 Space-Use Conflicts Between BOEM Program Areas

BOEM has identified some potential space-use conflicts or competing interests between BOEM's Program Areas within the proposed OCS oil and gas lease sale areas considered under the proposed action (Alternatives B-D). When considering all available unleased blocks within the lease sale area, there could be space-use conflicts within blocks that may contain Significant Sediment Resource Areas (SSRAs), are included in the Wind Energy Area Options as of April 2024, final identified WEAs, Wind Energy Lease(s) (i.e., OCS-G 37334), and that could be used for future carbon sequestration projects. However, in the event that incompatibilities would arise, BOEM could utilize lease stipulations to help mitigate the potential conflicts.

Within designated blocks that may contain SSRAs, there is an increased potential for competing interests between the use of OCS sediment resources for coastal restoration and leasing for OCS oil and gas resources. A list of the current OCS blocks in the GOM identified as potentially containing significant sediment resources, as well as their respective data layers, is available on BOEM's website at https://www.boem.gov/marine-minerals/managing-multiple-uses-gulf-mexico. As storms increase in frequency and strength, there has been and would continue to be, an increased need for sediment dredging for coastal resiliency. Because some SSRAs may be in the blocks available for OCS oil and gas leasing under Alternative B, BOEM uses Information to Lessees and NTLs to inform lessees of SSRAs and areas of active dredging. BOEM's NTL No. 2009-G04 states that bottom-disturbing activities (including surface or near-surface emplacement of platforms, wells, drilling rigs, pipelines, umbilicals, and cables) must avoid, to the maximum extent practicable, significant OCS sediment resources. Any activity that lasts more than 180 days and is located within 305 lateral meters (1,000 ft) and 20 vertical meters (65 ft) below the natural seafloor of any designated sediment resources is considered bottom disturbing and inconsistent with BOEM's NTL No. 2009-G04. BOEM has implemented measures to prevent obstructions to the use of the most substantial OCS sediment resources, reduce multiple-use conflicts, and minimize interference with OCS oil- and gas-related activities. In addition, BOEM may require OCS oil and gas lessees to undertake measures deemed economically, environmentally, and technically feasible to protect the SSRA resources to the maximum extent practicable. Measures may include modification of operations and monitoring of pipeline locations after installation. Under Alternatives C and D, blocks containing SSRAs are excluded from leasing and would therefore have less space-use conflicts with GOM oil and gas development as the result of the proposed action. However, limited space-use conflicts could still arise from actions that might temporarily occupy similar space (e.g., vessel traffic and pipeline installations), but those actions could still be mitigated through the use of plan or permit conditions of approval.

In addition, the placement of OCS oil and gas infrastructure, including the burial of pipelines in nearshore areas containing potential significant sediment resources, can cause long-term impediments to other uses of the OCS. As of October 2016, BSEE might not approve requests for in-place decommissioning of pipelines in these designated areas. For pipelines outside of these areas, BSEE Gulf of Mexico Regional Supervisor may permit decommissioning-in-place if the Gulf of Mexico Regional Supervisor determine that the pipeline does not constitute a hazard or obstruction to navigation and commercial fishing operations, unduly interfere with other uses of the OCS, or have adverse environmental effects. 30 C.F.R. § 250.1750. If it is deemed necessary, pipelines previously decommissioned in place may be required to be removed if BSEE's Gulf of Mexico Regional Supervisor determines that the pipeline is an obstruction. 30 C.F.R. § 250.1754.

Space-use conflicts between renewable energy activities in the Wind Energy Area Options (i.e., Areas A, B, C, D, E, F, G, and H) as of April 2024, the final identified WEAs (i.e., Areas I, J, K, L, and N), Wind Energy Leases (i.e., OCS-G 37334), and the placement of OCS oil and gas infrastructure could also occur under the proposed action (Alternatives B-D). The Wind Energy Area Options are described in the wind energy siting analysis and can be found on BOEM's website at https://www.boem.gov/sites/default/files/documents/renewable-energy/state-activities/GOM-WEA-Modeling-Report-Combined.pdf, and the final identified WEAs are detailed in the Memorandum for Area ID and can be found on BOEM's website at https://www.boem.gov/sites/default/files/documents/renewable-energy/state-activities/4683-Memorandum-for-Area-ID-GOM.pdf, and Wind Energy Lease OCS-G 37334 (https://www.boem.gov/renewable-energy/state-activities/lease-ocs-g-37334-rwe-offshore-us-gulf-llc) was executed on November 1, 2023. It should be noted that the WEA Options are subject to change in the future as the needs of BOEM's Renewable Energy Program mature. Renewable energy infrastructure occupies large areas and consists of many cables on the seafloor that connect the turbines and offshore substations. It could be difficult to place OCS oil and gas infrastructure within the same areas as the renewable energy infrastructure. In addition, there could be compounded safety issues from increased vessel traffic if renewable energy and OCS oil and gas infrastructure are placed near each other. However, the marine spatial planning modelling that BOEM performed with NOAA (Randall et al. 2022) included oil and gas infrastructure distancing when determining the appropriate locations of the WEAs (Celata 2022; Kendall 2023). BOEM may fund studies or additional modeling in the future to examine whether these areas are compatible if the potential for conflicts arises or as the needs of BOEM's Renewable Energy Program mature. Under Alternatives C and D, GOM oil and gas leasing is excluded from the WEAs and Call Area, respectively. These exclusions would minimize the space-use conflicts between OCS wind energy and oil and gas development. However, conflicts with vessel traffic may still occur.

At this time, BOEM and BSEE are developing proposed regulations that address the transportation and storage of CO_2 on the OCS. Future carbon sequestration projects in the GOM may have space-use issues with OCS oil- and gas-related activities. These projects are expected to be initially limited to saline reservoirs or depleted oil and gas reservoirs occurring close to shore due to cost and other considerations. These areas have also seen decreased oil and gas development interest. Therefore, under Alternatives B and C it is likely that space-use conflicts between carbon sequestration and OCS oil- and gas-related activities could be mitigated, and even further reduced under Alternative D.

Alternative A would limit adding more OCS oil- and gas-related, space-use conflicts that could occur with other OCS activities, including in the SSRA blocks, Wind Energy Options as of April 2024, final identified WEAs, Wind Energy Lease(s) (i.e., OCS-G 37334), and carbon sequestration-related activities. Within the SSRA blocks there would not be competing interests between the use of OCS sediment resources for coastal restoration and leasing for OCS oil and gas resources from the proposed action since the proposed OCS oil and gas lease sale would not occur. Limiting the amount of infrastructure that may be installed within SSRA blocks could reduce potential safety concerns with the installation or movement of infrastructure that may impact a borrow site. In addition, reducing space-use conflicts between potential on-lease infrastructure on an SSRA block, particularly pipelines, that restrict access to sediment resources ensures that potential sediment resource areas remain viable for dredging that could occur in the SSRA blocks. Similarly, under Alternative A, space-use conflicts and potential infrastructure incompatibility between renewable energy activities in the Wind Energy Options as of April 2024, final identified WEAs, and Wind Energy Lease(s) (i.e., OCS-G 37334) and the placement of OCS oil and gas infrastructure would not occur. Renewable energy infrastructure could be emplaced without the need for bottom-disturbing activity setbacks for OCS oil- and gas-related infrastructure and activities. In addition, there would not be increased vessel traffic in the area due to both renewable energy and new OCS oil- and gas-related activities in the same area. The carbon sequestration projects are an emerging use of the OCS. Limiting OCS oil and gas infrastructure space-use conflicts would allow more area for these potential new projects.

4.0.2.3 Decommissioning

OCSLA and its implementing regulations, as well as the terms and conditions of the offshore oil and gas leases, ROWs, and RUEs granted by Interior and other applicable laws and regulations, require lessees, operation right holders, and holders of rights-of-way (ROWs) and rights-of-use and easement (RUEs) to, among other things: (i) permanently plug all wells; (ii) remove all platforms and other facilities; (iii) decommission all pipelines; and (iv) clear the seafloor of all obstructions created by the lease, pipeline ROW, and RUE operations within one year after termination or when BSEE determines they no longer have future use (hereinafter, decommissioning activities). See 43 U.S.C. § 1334; 30 C.F.R. part 250, Subparts J and Q. The Bureau of Safety and Environmental Enforcement (BSEE) oversees the decommissioning and removal of infrastructure from the OCS. In 2005, the Minerals Management Service (MMS, predecessor agency to BOEM and BSEE) published the *Structure-Removal Operations on the Gulf of Mexico Outer Continental Shelf: Programmatic Environmental Assessment* (Decommissioning Programmatic EA) (MMS 2005). That evaluation encompasses all structure-removal operations (i.e., well abandonments, structure removals, pipelines and other appurtenances) currently under the regulatory authority of BSEE. Descriptions of decommissioning activities in the Decommissioning Programmatic EA (as summarized herein in **Chapter 3** and in more detail in **Appendix J**) are hereby incorporated by reference unless specifically updated in this Programmatic EIS. Since the issuance of the 2005 Decommissioning Programmatic EA, MMS, and later, BSEE has managed well, pipeline, and structure decommissioning operations in accordance with the description of the proposed activities and impacts analysis outlined in the National Environmental Policy Act (NEPA) document. Additionally, all applications for infrastructure decommissioning undergo additional, tiered NEPA reviews prepared by BOEM for potential impacts and other compliance requirements.

The Government Accountability Office (GAO) recently reviewed BSEE’s management of oil and gas pipelines (GAO 2021) and oversight of decommissioning deadlines (GAO 2024). The GAO 2021 report examined BSEE's processes for ensuring active pipeline integrity and addressing safety and environmental risks posed by decommissioning. The GAO recommended that BSEE take actions to further develop, finalize, and implement updated pipeline regulations to address long-standing limitations regarding its ability to (1) ensure active pipeline integrity and (2) address safety and environmental risks associated with pipeline decommissioning. The GAO 2024 report addressed reviewed the Department of the Interior's (DOI) effectiveness in enforcing decommissioning deadlines and assuring industry capacity to meet them. The GAO made four recommendations to DOI to strengthen BSEE and BOEM's decommissioning oversight and enforcement: (1) strengthen BSEE's approach to proactively overseeing and enforcing decommissioning deadlines; (2) complete planned actions to identify, propose, finalize, and fully implement changes to decommissioning regulations and guidance; (3) complete planned actions to further develop, finalize, and fully implement changes to financial assurance regulations and procedures that reduce financial risks; and (4) complete planned actions to assess and revise qualification procedures to address decommissioning capacity and compliance history. The DOI has agreed with all recommendations made by these GAO reports and is currently working towards their implementation. More detail on decommissioning activities is in

Appendix J of this Programmatic EIS and in Chapters 1.3.3.5, 5.2.7.4, and 5.3 of the GOM Oil and Gas SID.

4.0.3 Impact Analysis Framework

Chapters 4.1-4.17 describe the affected environment and analyze the potential impacts of a representative, single proposed OCS oil and gas lease sale on each resource category. These analyses incorporate by reference the baseline characterization of the environmental setting, affected environment, and description of potential impacts provided in the GOM Oil and Gas SID. New, relevant information released since development of the GOM Oil and Gas SID is included throughout the resource analyses below. Each resource analysis begins by defining the resource, summarizing the affected environment, identifying the relevant programmatic environmental concerns and impact-producing factors, and outlining the existing, applicable protective measures and regulatory requirements. An alternatives analysis for each resource compares the potential impacts from routine OCS oil- and gas-related activities and accidental events for each of the alternatives, including Alternative A (i.e., cancellation of a single proposed OCS oil and gas lease sale). followed by a summary of any incomplete or unavailable information and how it was addressed in the analysis. Cumulative impacts are analyzed separately for each resource and all alternatives collectively.

Lessees are required to perform OCS oil- and gas-related activities in accordance with all regulatory requirements. Therefore, this analysis includes the application of those regulatory requirements when making impact determinations. In addition, Alternatives B-D would require each lessee to avoid or minimize potential impacts on the environment by complying with various imposed lease stipulations or through post-lease conditions of approval. Mitigating measures in the form of lease stipulations are added to the lease terms and are therefore enforceable as part of the lease should the decisionmaker choose to implement them in a Record of Decision and Final Notice of Sale for a given proposed OCS oil and gas lease sale (refer to **Appendix F**). Post-lease mitigating measures are applied as conditions of approval for site-specific plans. In order to assist the decisionmaker in choosing which stipulations to apply, the impacts are analyzed both with and without the application of these potential protective measures. Impacts are described in each applicable resource analysis chapter below. Though the analysis factors in the mitigating effects of post-lease conditions of approval when making final impact determinations, the impacts with and without the application of these protective measures are also described in each applicable resource analysis chapter below.

Figure 4.0-1 is a “sand diagram” that shows the different layers of factors that could affect each resource category considered in this Programmatic EIS. The bottom two layers of the sand diagram (green and blue) are discussed in detail in the GOM Oil and Gas SID and 2024-2029 National OCS Oil and Gas Program Programmatic EIS. The potential effects from routine OCS oil- and gas-related activities are derived from knowledge and analyses of past and present activities (i.e., “blue layer”) but can be applied to the assessment of a proposed action as well (i.e., “orange layer”). The top two layers (orange and yellow) are analyzed in further detail below with the application of a specific development scenario, incorporating the initial screening and description of potential effects in the GOM Oil and Gas SID (BOEM 2023e) by reference.

The discussion of the baseline conditions (green and blue layers) considers everything that is currently affecting the resource and includes all existing and past natural and anthropogenic IPFs other than OCS oil- and gas-related activities associated with future Gulf of Mexico OCS oil and gas leasing. Non-OCS oil- and gas-related IPFs (green layer) include, but are not limited to, natural events such as major storms and hurricanes, climate change and ocean acidification, and other IPFs not associated with the proposed action such as commercial fishing, nonpoint-source runoff, fossil fuel combustion, military operations, and State oil and gas activities (refer to Chapter 3 of the GOM Oil and Gas SID). Past and present OCS oil- and gas-related activities (blue layer) is the second component of baseline conditions considered in this Programmatic EIS. The analysis of the action alternatives (orange layer) examines the effects that could occur from routine OCS oil- and gas-related activities and accidental events associated with a single proposed GOM oil and gas lease sale. Each resource chapter makes impact determinations using the general impact-level definitions in **Tables 4.0-3 and 4.0-4**. Conclusions are reached for adverse impacts, and any beneficial impacts are identified and classified with a conclusion level where possible.

The cumulative analysis (**Chapter 4.17**) considers environmental and socioeconomic impacts that may result from the incremental impacts of a proposed action and the cumulative impacts of a proposed action when added to all past, present, and reasonably foreseeable future OCS oil- and gas-related activities, as well as non-OCS oil- and gas-related activities (e.g., import tankering and commercial fishing). This includes projected activity from OCS oil and gas lease sales that have been held but for which exploration or development has not yet begun or is continuing. The effects of a proposed OCS oil and gas lease sale (orange) are evaluated in context and addition to the effects of all past, present, and future IPFs (both OCS oil- and gas-related and non-OCS oil- and gas-related; green, blue, and yellow layers) to determine the potential cumulative and incremental effects of a single proposed OCS oil and gas lease sale on each resource.

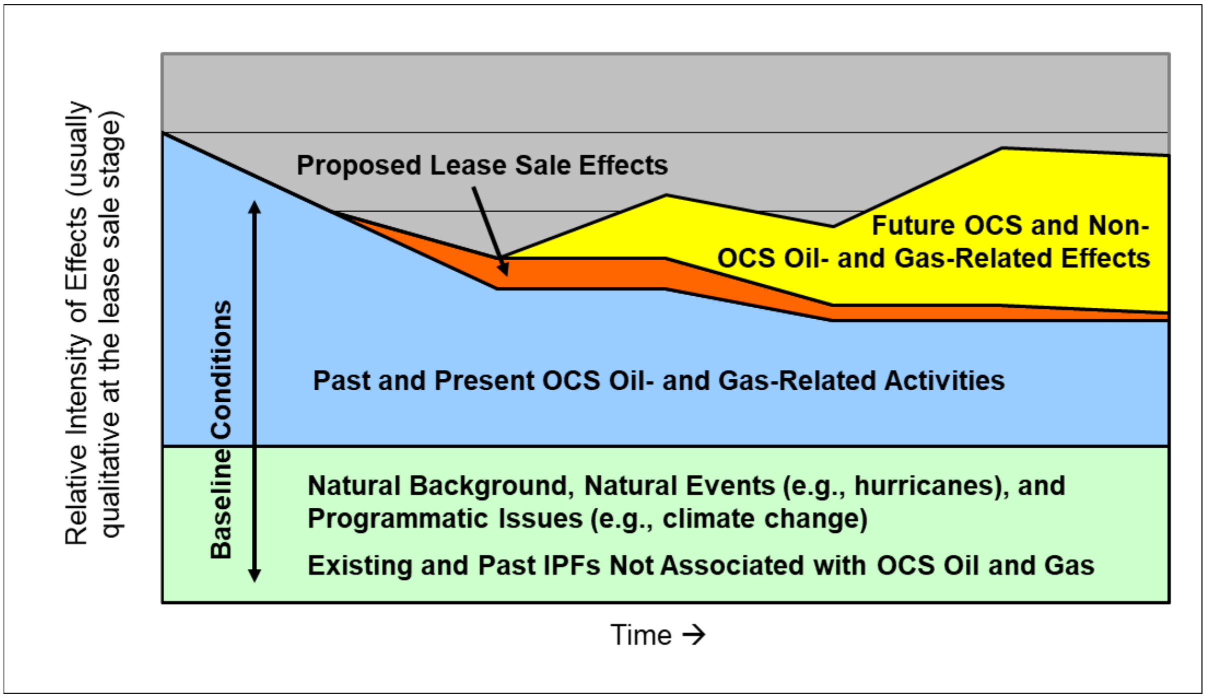

Figure 4.0-1. Sand Diagram of How an Effects Analysis is Layered (sand diagram is illustrative only and is not intended to depict actual scale or estimates for the various activities).

Table 4.0-3. Potential Adverse Impact-Level Definitions.

Impact Level	Biological, Archaeological, and Other Physical Resources	Socioeconomic Resources
None	The action has no effect.	The action has no effect.
Negligible	No measurable or detectable impacts. Impacts would be indistinguishable from localized existing conditions. *The disturbance would not result in any perceptible changes in behavior of protected species.*	No measurable or detectable impacts.
Minor	**Adverse localized impacts on the affected resource(s), including** • the local ecosystem health; • the extent and quality of local habitat for both special-status species and species common to the proposed project area; • acute change(s) in behavior but no mortality or permanent injury to an individual or group of protected species; • the richness or abundance of local species common to the proposed project area; • a measurable negative impact on air quality that is likely influenced by the emissions or distinguishable from localized existing conditions; • water quality; and • archaeological resource(s) could be avoided; • **OR** measurable impacts that occur would be small and the affected resource is expected to recover completely without remedial or mitigating action.	**Adverse localized impacts on the affected resource(s), including** • most adverse impacts on the affected activity or community could be avoided; • impacts would not disrupt the normal or routine functions of the affected activity or community; • **OR** the affected activity or community is expected to return to a condition with no measurable effects without remedial or mitigating action.

<table>
<tr><th>Impact Level</th><th>Biological, Archaeological, and Other Physical Resources</th><th>Socioeconomic Resources</th></tr>
<tr><td>Moderate</td><td>A notable and measurable localized adverse impact on the affected resource(s), including
the local ecosystem health;
the extent and quality of local habitat for both special-status species and species common to the proposed project area;
impacts to protected species, some of which may be irreversible, that would include chronic behavioral changes or even death but that would not affect the fitness of the population;
the richness or abundance of local species common to the proposed project area;
a notable and measurable negative impact on air quality that is likely influenced by the emissions or distinguishable from localized existing conditions;
water quality; and
archaeological resource(s) would be anticipated, some of which may be irreversible;
OR the affected resource would recover completely when remedial or mitigating action is taken.</td><td>A notable and measurable localized adverse impact on the affected resource(s), including
mitigation would reduce adverse impacts substantially during the life of the proposed project, including decommissioning;
the affected activity or community would have to adjust somewhat to account for disruptions due to notable and measurable adverse impacts of the project;
OR once the impacting agent is gone, the affected activity or community is expected to return to a condition with no measurable effects when remedial or mitigating action is taken.</td></tr>
<tr><td>Major</td><td>A regional or population-level impact on the affected resource(s), including
ecosystem health;
the extent and quality of habitat for both special-status species and species common to the proposed project area;
physical injury, permanent disruption of behavioral patterns, or mortality of protected species to the extent the viability of the population is diminished;
species common to the proposed project area;
a notable and measurable negative impact on air quality, localized or regional, with chronic effects that would not fully recover even after remedial action is taken;
water quality; and
archaeological resource(s) would be anticipated;
AND the affected resource would not fully recover, even after the impacting agent is gone and remedial or mitigating action is taken.</td><td>A regional or population-level impact on the affected resource(s), including
mitigation would reduce adverse impacts somewhat during the life of the proposed project, including decommissioning;
the affected activity or community would have to adjust to significant disruptions due to large local or notable regional adverse impacts of the project;
AND the affected activity or community may retain measurable effects indefinitely, even after the impacting agent is gone and remedial action is taken.</td></tr>
</table>

Note: Additions to the above impact-level definitions for protected species are in italics.

Table 4.0-4. Potential Beneficial Impact-Level Definitions Being Considered.

Impact Level	Biological, Archaeological, and Other Physical Resources	Socioeconomic Resources
Negligible	Either no effect or no measurable or detectable impacts.	Either no effect or no measurable or detectable impacts.
Minor	**A small and measurable localized** • improvement in ecosystem health; • increase in the extent and quality of habitat for both special-status species and species common to the proposed project area; • increase in individuals or population(s) of species common to the proposed project area, which maintains or aids in species recovery to ideal population size or carrying capacity; • improvement in air or water quality; • **OR** limited aerial extent or short-term temporal duration of improved protection of archaeological resource(s).	**A small and measurable** • improvement in human health; • benefits for employment; • improvement to infrastructure/facilities and community services; • economic improvement; • **OR** benefit for tourism or cultural resources.
Moderate	**A notable and measurable localized** • improvement in local ecosystem health; • increase in the extent and quality of local habitat for both special-status species and species common to the proposed project area; • increase in individuals or populations of species common to the proposed project area, which maintains or aids in species recovery to ideal population size or carrying capacity; • improvement in air or water quality; • **OR** extensive/complete aerial extent, or long-term temporal duration of, improved protection of archaeological resource(s).	**A notable and measurable** • improvement in human health; • benefits for employment; • improvement to infrastructure/facilities and community services; • economic improvement; • **OR** benefit for tourism or cultural resources.
Major	**A regional or population-level** • improvement in the health of ecosystems; • increase in the extent and quality of habitat for both special status and commonly occurring species; • improvement in air or water quality; • **OR** permanent protection of archaeological resource(s).	**A large local or notable regional** • improvement in human health; • benefits for employment; • improvement to infrastructure/facilities and community services; • economic improvement; • **OR** benefit to tourism or cultural resources.

4.1 AIR QUALITY

"Air quality" is the degree to which the ambient air is free of pollution generated from numerous factors, including natural and anthropogenic air emissions. The term "air emission" means the gases and particles emitted by various sources. The term ambient air means that portion of the atmosphere, external to buildings, to which the public has access (40 CFR § 50.1(e)). Both air emissions and ambient air pollutants were used in this analysis. For example, ozone (O_3) is not an air emission but is an ambient air pollutant (USEPA 2020b).

Air quality is evaluated by a variety of pollution indicators including criteria air pollutants (CAPs), hazardous air pollutants (HAPs), greenhouse gases (GHGs), visibility, and other factors. Many pollution indicators, such as CAPs and HAPs, are known to have direct and indirect effects to air quality.

Pollutant greenhouse gas types are considered in this analysis for air quality because there are direct effects on human health from ambient concentrations of pollutant greenhouse gases (USEPA 2009). Also, carbon-containing air pollutants, including methane (CH_4), contribute to the formation of O_3 (USEPA 2020b). Greenhouse gases also contribute to the "greenhouse effect" that influences Earth's climate (National Research Council 2020) and are a significant driver of human-caused climate change. This chapter focuses on the effects to air quality and not climate change. Greenhouse gases from the proposed action, and how they would contribute to future effects from climate change, are discussed in **Chapter 4.0.2.1** and **Appendix H**.

Air emissions and pollution are mobile. They can also chemically transform in the atmosphere, and deposit on solid surfaces and water. The mixing of air emissions and pollution is influenced by the meteorology of the region (Biazar et al. 2010); therefore, evaluating both air emissions and meteorological conditions (e.g., temperature, sunlight, precipitation, and wind) is important when assessing air quality. Circulation patterns, geography, time of day, season, and other variables can also influence the dispersion and chemical transformation of pollutants and overall air quality of a region.

4.1.1 Affected Environment

For this analysis, the affected environment comprises parts of the WPA, CPA, and EPA including the States of Texas, Louisiana, Mississippi, Alabama, and Florida and their respective State waters, as depicted in Figure 4.1-1 of the GOM Oil and Gas SID. This area also includes national parks and Federal wilderness areas (e.g., Breton Wilderness Area) where air quality and air quality-related values (AQRVs) are protected more stringently than under the National Ambient Air Quality Standards (NAAQS). Chapter 4.1 of the GOM Oil and Gas SID examined the AQRVs (i.e., visibility, potential deposition effects, and potential ozone effects) for the Breton Wilderness Area as well as the following primary pollutants:

- criteria air pollutants[4] (CAPs)—CO, Pb, NO_x (includes NO_2), SO_2, PM_{10}, and $PM_{2.5}$;
- criteria precursor air pollutants (CPAPs)—NH_3, VOCs, and NO_x;
- select hazardous air pollutants (HAPs) and sources; and
- greenhouse gases (GHGs)—CO_2, CH_4, and N_2O.

Ambient air quality monitoring shows that onshore CAP levels along the Gulf Coast are below the NAAQS, except for the Houston-Galveston-Brazoria nonattainment area for O_3 and the St. Bernard nonattainment area for sulfur dioxide (SO_2) (**Figure 4.1-1**).

[4] Though not directly emitted, O_3 is also a criteria air pollutant formed from photochemical reactions.

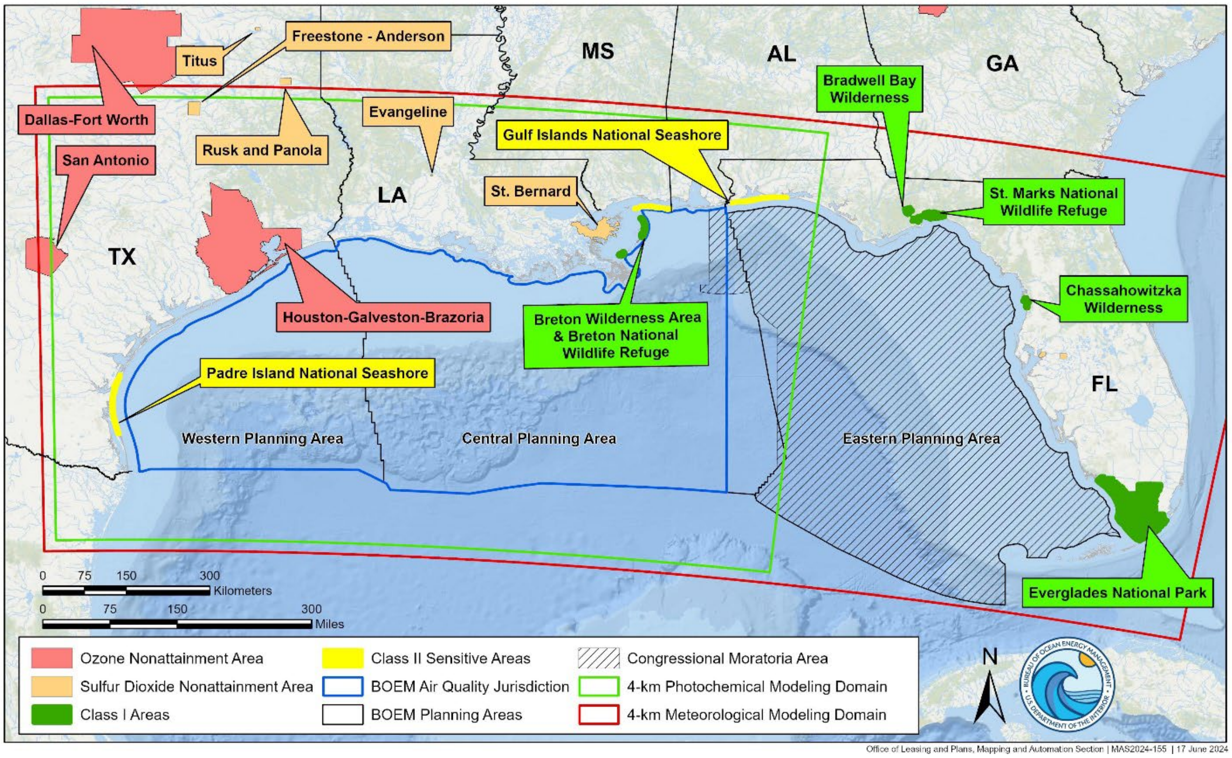

Figure 4.1-1. Gulf of Mexico Region with the Planning Areas, Nonattainment Areas, BOEM's Air Quality Jurisdiction, and Class I and Sensitive Class II Areas.

There is limited monitoring data for ambient concentrations of HAPs and GHGs for the region (USEPA 2009; 2023a). Therefore, emission inventory reports were used to estimate air emissions for HAPs and GHGs. The *Air Quality Modeling in the Gulf of Mexico Region* (Wilson et al. 2019b), *Year 2017 National Emissions Inventory Data* (USEPA 2020a), and *Year 2017 Emission Inventory Study* (Wilson et al. 2019a) were used to support this analysis and are incorporated by reference. Some offshore emissions reported in the emission inventories are regulated through air quality reviews of oil and gas plans (30 CFR part 550), air quality permits (40 CFR part 55) in the areas under USEPA jurisdiction, and the International Convention for the Prevention of Pollution from Ships (MARPOL) Annex VI and the Act to Prevent Pollution from Ships (APPS) (33 U.S.C. §§ 1901-1915).

Current conditions of AQRVs on Breton Wilderness Area for visibility and acid deposition are known through air quality monitoring and were used to support this analysis (National Atmospheric Deposition Program 2021; 2023b; USEPA 2020d). The two National Atmospheric Deposition Program's (NADP) sites monitoring nitrogen deposition near the Breton Wilderness Area are (1) the Southeast Research Station (LA30) located in Washington Parish, Louisiana; and (2) the Grand Bay National Estuarine Research Reserve (MS12) located in Jackson County, Mississippi (National Atmospheric Deposition Program 2023a). The MS12 site's year 2022 total nitrogen deposition was 3.0 kilograms/hectare (kg/ha) (National Atmospheric Deposition Program 2023c). The LA30 site's year 2022 total nitrogen deposition was 3.8 kg/ha (National Atmospheric Deposition Program 2023b). Across the U.S, critical loads range from 2.8 to 5.6 $kg \cdot ha^{-1} \cdot yr^{-1}$ (Clark et al. 2018). Critical load "is used to describe the threshold of air pollution deposition that causes change to sensitive resources in an ecosystem;" thus, if the critical load threshold is exceeded, some effects may be experienced by sensitive resources (National Atmospheric Deposition Program 2020). The nitrogen deposition threshold value for the Eastern U.S. is 0.010 $kg \cdot ha^{-1} yr^{-1}$ (USFS et al. 2010). The FWS, which manages the Breton Wilderness Area, has not established metrics for determining phytotoxic ozone concentrations (i.e., concentrations where negative effects on vegetation could be expected). Therefore, AQRV for ozone effects on the Breton Wilderness Area are unknown; however, the Breton Wilderness Area has some protection from ozone due to the secondary ozone NAAQS (8-hr O_3) standards.

Most HAP emissions are from onshore sources. However, acetaldehyde, benzene, ethylbenzene, formaldehyde, hexane, toluene, and xylenes from OCS oil- and gas-related sources contributed more than the 10 tons (11 short tons) per year threshold (adapted from the Clean Air Act Amendments § 7412(a)(1)) as shown in Table 2.1.1-2 of the GOM Oil and Gas SID, which may be substantial enough to influence local air quality. The OCS oil- and gas-related sources contributed approximately 1-4 percent of total HAP emissions for each HAP, whereas non-OCS oil- and gas-related sources contributed approximately 96-99 percent in the offshore areas of the Gulf of Mexico and onshore areas of the five Gulf Coast States (refer to **Chapter 3.4.1** of this Programmatic EIS and Chapter 2.1 of the GOM Oil and Gas SID). These HAP emission estimates do not consider accidental event IPFs, which should also be considered when evaluating impacts to air quality for existing conditions. Since there are many variables that can influence the degree of impacts (e.g., location, meteorological conditions, and source type), each HAP emission has different localized and regional impacts on air quality, with urban areas within the GOM region likely to experience the most effects because of the higher density of air emission sources. Houston, Texas, had annual HAP concentrations less than their respective long-term air monitoring comparison values (AMCVs), except for benzene (Phillips et al. 2022). Acetaldehyde, benzene, and formaldehyde likely have the greatest effects to air quality compared to other HAPs because acetaldehyde, benzene, and formaldehyde emissions contribute more than 50 percent to public health risks at a national level (USEPA 2014).

Non-OCS oil- and gas-related sources and oil- and gas-related sources contribute 89 percent and 11 percent of the methane (CH_4) emissions in the GOM region, respectively (refer to Chapters 4.1.2.1 and 4.1.2.2 of the GOM Oil and Gas SID). While there are more methane emission sources from non-OCS oil- and gas-related activities when compared to routine OCS oil- and gas-related activities (refer to **Chapter 3**), petroleum and natural gas systems onshore and offshore are major contributors of anthropogenic methane to the environment at a national level (USEPA 2023d). The most immediate effects from methane emissions would occur in localized areas, whereas areas farther from the source would experience less effects due to the oxidation of methane (BSEE 2015; Forster et al. 2007).

4.1.2 Environmental Consequences

Air quality in the GOM is affected by existing environmental conditions, natural processes and phenomena, and human-induced factors as described in Chapter 4.1 of the GOM Oil and Gas SID. There are several OCS oil- and gas-related activities and non-OCS oil- and gas-related activities that have the potential to impact air quality (**Table 4.1-1**). BOEM conducted an initial screening of IPFs in the GOM Oil and Gas SID and determined that air emissions and pollution and accidental events (unintended releases into the environment and response activities) could potentially impact air quality. These IPFs and their potential to affect air quality are discussed below and in greater detail in Chapter 4.1.2 of the GOM Oil and Gas SID. Supporting rationale for IPFs that were not analyzed in detail in this Programmatic EIS can also be found in Chapter 4.1.2 of the GOM Oil and Gas SID. New information released since development of the GOM Oil and Gas SID and relevant to the analysis is included below.

Table 4.1-1. Impact-Producing Factors with the Potential to Impact Air Quality.

OCS Oil- and Gas-Related Routine Activities	OCS Oil- and Gas-Related Accidental Events	Non-OCS Oil- and Gas-Related Activities
Air Emissions and Pollution	Unintended Releases into the Environment	Air Emissions and Pollution
-	Response Activities	Climate Change
-	-	Other Cumulative Factors

There are several existing regulatory programs and requirements to reduce or minimize the environmental effects of these IPFs to air quality in the GOM (**Table 4.1-2**). For example, BOEM's regulations require air quality reviews for all post-lease plans (refer to Chapter 5.6 of the GOM Oil and Gas SID) and, if required based on site-specific environmental reviews, BOEM assigns conditions of approval that are enforced by BSEE. Lessees are required to conduct OCS oil- and gas-related activities in accordance with all regulatory requirements; therefore, the analysis factors in the mitigating effects of all applicable regulatory requirements when making impact determinations for routine activities.

Table 4.1-2. Existing Regulatory Requirements and Protective Measures That Reduce the Potential Impacts of Impact-Producing Factors.

Regulatory Requirement or Protective Measure[1]	Enforcing Agency	Impact-Producing Factor(s) Reduced/Avoided	Supporting References and Sections
Air quality reviews of all site-specific plans for compliance with NAAQS through OCSLA[2]	BOEM, BSEE	Air Emissions and Pollution – CAPs only	Chapter 5.6 of the GOM Oil and Gas SID, 30 CFR part 550, 30 CFR part 250
International Convention for the Prevention of Pollution from Ships (MARPOL) Annex VI and the Act to Prevent Pollution from Ships (APPS)	USEPA, USCG	Air Emissions and Pollution – CAPs only	33 U.S.C. §§ 1901-1915 – Prevention of Pollution from Ships
Air quality permits for compliance with Section 328 of the Clean Air Act[3]	USEPA	Air Emissions and Pollution – CAPs and HAPs only	40 CFR part 55

[1] Refer to Chapter 6 of the GOM Oil and Gas SID for conditions of approval commonly applied at the post-lease stage.
[2] Only for activities in the Central and Western Planning Areas (west of longitude 87.5 degrees).
[3] Only for activities in the Eastern Planning Area (east of longitude 87.5 degrees).

4.1.2.1 OCS Oil- and Gas-Related Impact-Producing Factors from Routine Activities

Equipment such as drilling rigs, vessels, and fixed facilities associated with OCS oil- and gas-related activities have sources of emissions from diesel or gasoline engines, dual fuel turbines, pneumatic pumps, vents, flares, and other source types as identified in **Chapter 3.4.1** of this Programmatic EIS and Chapter 2.2.1 of the GOM Oil and Gas SID.

Air Emissions and Pollution: The *Air Quality Modeling in the Gulf of Mexico Region* (Wilson et al. 2019b) study is used to address modeled ambient air concentrations, where possible, and the *Year 2017 Emission Inventory Study* (Wilson et al. 2019a) is used for estimating baseline emissions[5] for a single proposed OCS oil and gas lease sale. **Table 3.4-1** lists the phases and related sources of air emissions associated with OCS oil- and gas-related activities. Chapter 2.1.1 of the GOM Oil and Gas SID discusses the OCS oil- and gas-related activities causing air emissions, including their estimated air emissions under existing baseline conditions.

Overall, the routine OCS oil and gas CAP and CPAP emissions reported in year 2017 decreased compared to year 2014 (Wilson et al. 2019a). When the total CAP and CPAP emissions of the GOM are combined, the routine OCS oil- and gas-related activities for the ongoing OCS Oil and Gas Program contributed less than 1 percent of SO_2, PM_{10}, $PM_{2.5}$, Pb, VOCs, NH_3, and CO, and 3 percent for NO_x to the total CAP and CPAP emissions in 2017. For total HAP emissions in the GOM, routine OCS oil- and gas-related activities for the ongoing OCS Oil and Gas Program contributed an estimated 1-4 percent for each of the 28 HAPs. For total GHG emissions in the GOM, routine OCS oil- and gas-related activities for the ongoing OCS Oil and Gas Program contributed an estimated 1 percent for CO_2, 11 percent for CH_4, and 1 percent for N_2O.

Gorchov Negron et al. (2023) determined that the *Year 2017 Emission Inventory Study* (Wilson et al. 2019a), which is incorporated by reference and used to support this analysis, underestimates reporting of methane emissions from shallow-water facility sources such as cold vents (Ayasse et al. 2022; Gorchov Negron et al. 2023). The cold vents involve direct release of natural gas into the atmosphere (i.e., venting), usually for operational and safety reasons (DOE 2019). The potential causes for the underestimates of methane emissions from shallow-water facilities could be unintended releases of methane (i.e., accidental events) or undetected leaks, noncompliance issues, misquantification of releases (e.g., flare efficiencies[6] used to calculate methane emissions in the emission inventories), or misreporting[6]. Right-of-way facilities are also being investigated for misreporting methane emissions. Approximately 36 platforms (14.4%) of total non-reporters in the *Year 2017 Emissions Inventory Study* were from right-of-way facilities.

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[5] **Chapter 4.1.3** discusses why the *Year 2017 Emission Inventory Study* (Wilson et al. 2019a) is used in this analysis rather than the *Outer Continental Shelf Air Quality System (OCS AQS): Year 2021 Emissions Inventory Quality Assurance/Quality Control (QA/QC) Study* (Thé et al. 2023).

[6] The *Year 2017 Emissions Inventory Study* assumed flares are operating under stable conditions with a combustion efficiency of about 98% unless an operator reported otherwise (Wilson et al. 2019a). A lower combustion efficiency value would increase methane emission estimates in the inventory.

A recent report from the Office of Inspector General (OIG) found concerns with inaccurate venting and flaring records submitted to BSEE by one company related to six of their more than 500 offshore facilities (Office of Inspector General 2022). It is possible that the “superemitters” of shallow-water oil and gas platforms described in the Gorchov Negron et al. (2023) study correlates to the findings in the Office of Inspector General (OIG) report on venting and flaring records and concerns that an unknown number of shallow-water operators are emitting more methane than they are reporting (Office of Inspector General 2022).[7] The OIG report provided BSEE with two recommendations. First it recommended that BSEE revise its annual facility inspection procedures to require inspectors to examine flaring reports for patterns that may reflect regulatory or statutory violations or amounts that exceed permissible limits. The OIG also recommended that BSEE develop a documented process to coordinate with Office of Natural Resources Revenue if violations are detected to ensure that Office of Natural Resources Revenue receives the royalties owed for improperly vented or flared natural gas. BSEE implemented both OIG recommendations.[8]

If similar discrepancies as described in the OIG (2022) report were occurring on a large scale, it could indicate that emissions for VOC, CO_2, CH_4, and HAPs are underestimated in the *Year 2017 Emissions Inventory Study*. While literature and the OIG report indicate that the *Year 2017 Emissions Inventory Study* underestimate methane emissions, the reasons as to why this is occurring, and to what extent, are unclear. BOEM will continue working closely with BSEE to ascertain the extent and causes of underreported methane emissions and possible implications to future emissions inventory estimates.

Though there are uncertainties in the methane data, the *Year 2017 Emissions Inventory Study* and underlying assumptions (e.g., compliance with existing regulatory requirements) provide a reasonable and credible scenario for purposes of this NEPA analysis without being overly speculative (refer to 43 CFR § 46.30). Gorchov Negron et al. (2023) did find that CO_2 and NO_x emissions were well represented. Furthermore, the *Outer Continental Shelf Air Quality System (OCS AQS): Year 2021 Emissions Inventory Quality Assurance/Quality Control (QA/QC)* study investigated the calculation methods between calendar years 2017 and 2021 and did not identify any errors in the methane calculations (Thé et al. 2023).

The *Year 2017 Emissions Inventory Study* helps BSEE and BOEM identify noncompliance with air quality regulations, such as the misreporting of activity or equipment. BSEE continually works

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[7] A flare on a shallow-water facility was releasing an unknown amount of uncombusted natural gas. A recent BSEE inspection at the shallow-water facility documented routine flaring activity from a potential misreported flare. There were concerns of the age, design, operating parameters, maintenance, and useful life of the flare, which are critical factors in determining the volume of uncombusted natural gas. The amounts of methane released are unknown. No fugitive sources (i.e., leaks) were identified during the inspection.

[8] BSEE’s response to OIG recommendations: “BSEE concurs with this recommendation and will develop inspection procedures that identify clear violations as well as suspicious patterns on flare/vent records like those discovered by OIG. BSEE will also develop specific training regarding the inspection of flare/vent records, which will include instruction on finding potential violations similar to those identified by OIG. That training will then be given to BSEE inspectors as well as BSEE engineers who are authorized to approve flaring/venting requests.”

on reducing the likelihood of incidents of noncompliance. The frequency of noncompliance with air quality regulations is unclear, and it remains difficult to identify the number of shallow-water facilities underestimating methane emissions, as well as the number of facilities that could be overestimating methane emissions reported in the entire emission inventories. There are currently no offshore air quality monitors that can be used to monitor facilities; however, BOEM, BSEE, NASA, and NOAA are actively collaborating on how to incorporate remote sensing technologies to improve monitoring of methane emissions and regulatory compliance in the future (Dahan et al. 2022; Gorchov Negron et al. 2023).

4.1.2.2 OCS Oil- and Gas-Related Impact-Producing Factors from Accidental Events

Unintended Releases into the Environment: Unintended releases into the environment associated with existing oil and gas leases can result in air emissions and pollution as discussed in **Chapter 3.5**. The air emissions from OCS oil- and gas-related accidental events depends upon the exploration and production products (i.e., oil and gas). The air emissions could include CPAPs, CAPs, HAPs, GHGs, and H_2S. As mentioned above, the reasons for the underestimated methane emissions reported at shallow-water facilities (Gorchov Negron et al. 2023) may potentially be from unintended releases of methane (i.e., accidental events), undetected leaks, misquantification, misreporting, or noncompliance events.

Response Activities: Response activities caused by oil spills may use scheduled burnings or dispersants to minimize any potentially significant degradations to air quality from the release itself (National Academies of Sciences, Engineering, and Medicine 2022b); however, response activities can also impact air quality through air emissions from equipment, vessels, aircraft, burning of gas and oil, and the application of dispersants via aircraft. For more information on accidental events, refer to **Chapter 3.5**.

4.1.2.3 Alternatives Analysis

BOEM conducted an initial screening of IPFs in the GOM Oil and Gas SID and determined that air emissions and pollution, unintended releases into the environment, and response activities could impact air quality. Impacts were analyzed using the lowest and highest annual activity projections within the 40-year analysis period of a single OCS oil and gas lease sale to extrapolate the potential range of emissions. Based on the preliminary screening of air pollutants in Chapter 4.1.2.2.1 of the GOM Oil and Gas SID, the following air pollutants were carried forward for analysis in this Programmatic EIS: 1-hr NO_2 (CAP); annual NO_2 (CAP); 24-hr $PM_{2.5}$ (CAP); annual $PM_{2.5}$ (CAP); 8-hr O_3 (CAP); acetaldehyde (HAP); benzene (HAP); ethylbenzene (HAP); formaldehyde (HAP); hexane (HAP); toluene (HAP); xylenes (HAP); and CH_4 (GHG), as well as AQRVs on nitrogen deposition impacts and potential O_3 effects on vegetation for the Breton Wilderness Area.

Alternative A – No Action (Cancellation of a Single Proposed OCS Oil and Gas Lease Sale)

Under Alternative A, a proposed OCS oil and gas lease sale would not occur, so there would be no new routine activities or accidental events resulting from the proposed action. Therefore, the direct or indirect impacts to air quality from air emissions and pollution, unintended releases into the environment, or response activities that would occur as a result of the proposed action (i.e., a single proposed oil and gas lease sale) would be **none**. However, there are ongoing OCS oil- and gas-related activities and other non-OCS oil- and gas-related activities that contribute to the baseline environment (summarized in **Chapter 4.0.1** of this Programmatic EIS with more detail in Chapter 3 of the GOM Oil and Gas SID) that also affect air quality and would still occur. Ongoing activities associated with previous OCS oil and gas lease sales (**Table 3.3-2**) could still have potential direct impacts to air quality through air emissions and pollution, unintended releases into the environment, and response activities as summarized above in **Chapter 4.1.2.2** and evaluated as part of the cumulative analysis in **Chapter 4.17.1**.

Comparison of Impacts under Alternatives B, C, and D

A regionwide OCS oil and gas lease sale under Alternatives B through D, and the resulting OCS oil- and gas-related development on any subsequent leases from the lease sale, would result in air emissions and pollution and potentially accidental events that could impact air quality.

Alternative B represents the largest geographic area under consideration for a regionwide lease sale. Alternatives C and D represent geographical constraints on available acreage for leasing, which could change the spatial distribution of the scenario activities but not overall activity levels. Therefore, this alternatives analysis focuses on the potential environmental impacts of a regionwide lease sale (Alternative B) and then considers if these potential impacts could be reduced or altered by the geographic constraint under each alternative considered (Alternatives C and D).

Table 4.1-3 shows the impact determinations for each routine and accidental IPF that affects air quality for each action alternative analyzed. The impacts of Alternative A are not shown in **Table 4.1-3** because the impacts would be avoided for all IPFs.

Table 4.1-3. Impact Determinations for Routine and Accidental Impacts to Air Quality for Alternatives B-D.

Impact-Producing Factor	BOEM's Protective Measure[1]	Alternative B	Alternative C	Alternative D
Air Emissions and Pollution	N/A	**Negligible** to **Moderate**	Same as Alternative B but with potentially less methane emissions	Same as Alternative B but with potentially less methane emissions
Unintended Releases into the Environment	N/A	**Minor** to **Moderate**	**Minor** to **Moderate**	**Minor** to **Moderate**
Response Activities	N/A	**Minor** to **Moderate**	**Minor** to **Moderate**	**Minor** to **Moderate**

Note: Alternative A is not shown in the table because the impacts from all impact-producing factors would be **none**.
[1] No programmatic protective measures for air quality (e.g., lease stipulations) for inclusion at the lease sale stage are being contemplated in this Programmatic EIS. All BOEM protective measures for air quality would be considered and applied at the site-specific stage and, therefore, are considered part of the proposed action across all action alternatives (refer to Chapter 6 of the GOM Oil and Gas SID).

Alternative B – Regionwide OCS Lease Sale

Air Emissions and Pollution

Criteria Air Pollutants (CAPs): Wilson et al. (2019b) represents reasonable assumptions and estimates that remain suitable for this programmatic impact analysis for a single lease sale. A single lease sale's OCS oil- and gas-related sources could contribute up to 7.2 percent to the 1-hr NO_2 NAAQS, 4.5 percent to the annual NO_2 NAAQS, 2 percent to the 24-hr $PM_{2.5}$ NAAQS, 5.6 percent to the annual $PM_{2.5}$ NAAQS, and 6 percent to the 8-hr O_3 NAAQS, which could result in potentially **minor** to **moderate** impacts to air quality.

Hazardous Air Pollutants (HAPs): **Table 4.1-4** shows the estimated HAP emissions from a single lease sale using the scenario ranges in **Table 3.3-1** to calculate emissions based on averages from the *Year 2017 Emission Inventory Study* (Wilson et al. 2019a). Under the high-case activity scenario, there is the potential for up to **moderate** impacts from formaldehyde emissions, while impacts from all other HAPs are expected to be **negligible** to **minor**. Under the low-case scenario, all HAPs resulting from a single lease sale would be expected to have **negligible** impacts to air quality.

Table 4.1-4. Regionwide OCS Lease Sale Low- to High-End Estimated HAP Emissions in Tons per Year (tpy) by Water-Depth Range.

Water Depth (m)	Acetaldehyde (tpy)	Benzene (tpy)	Ethylbenzene (tpy)	Formaldehyde (tpy)	Hexane (tpy)	Toluene (tpy)	Xylenes (tpy)
0-60	0.1-2.3	0.0-1.0	0.0-0.1	0.3-5.8	0.0-1.9	0.0-0.5	0.0-0.4
60-200	0.1-2.5	0.0-2.1	0.0-0.2	0.3-7.0	0.0-5.4	0.0-1.7	0.0-1.0
200-800	0.1-1.9	0.0-1.8	0.0-0.2	0.3-4.9	0.0-2.7	0.0-1.8	0.0-1.0
800-1,600	0.1-3.6	0.0-1.0	0.0-0.1	0.3-7.7	0.0-1.3	0.0-0.5	0.0-0.3
1,600+	0.1-4.3	0.0-0.7	0.0-0.1	0.3-8.7	0.0-1.7	0.0-0.3	0.0-0.3
TOTALS	**0.7-14.7**	**0.2-6.5**	**0.0-0.8**	**1.4-34.0**	**0.0-13.0**	**0.0-4.9**	**0.0-3.0**

Methane: **Table 4.1-5** shows the estimated methane emissions from a single oil and gas lease sale using the scenario ranges in **Table 3.3-1** to calculate emissions based on averages from the *Year 2017 Emission Inventory Study* (Wilson et al. 2019a). **Table 4.1-5** also indicates that higher estimated methane emissions would be expected in water depths less than 200 m (656 ft). Shallow-water facilities commonly vent gas, while deepwater facilities commonly flare gas (burning of natural gas). This is likely because shallow-water facilities tend to be older and not equipped with flares, the volume of gas production tends to be higher than deep water, and/or the type of structures are different than in deep water (Argonne National Laboratory 2017; Gorchov Negron et al. 2023).

Under the projected activity levels high-case scenario, a single OCS oil and gas lease sale could contribute about 0.2 percent to the annual methane emissions from all activities in the GOM region, resulting in **negligible** impacts to air quality under existing conditions. However, because of the uncertainty with the underestimated methane emissions for shallow-water facilities in the *Year 2017 Emissions Inventory Study* used to estimate the single proposed OCS oil and gas lease sale methane emissions in **Table 4.1-5**, impacts could be up to **moderate**. Methane has a low photochemical reactivity (40 CFR § 51.100(s)) and a small effect to O_3 production. Localized areas near the methane source(s) would experience the most immediate effects, likely in areas with water depths of 0-200 m (0-656 ft). It is reasonable to expect fewer venting activities from development occurring on future leases issued in water depths greater than 200 m (656 ft) because deepwater facilities commonly flare gas rather than vent (Argonne National Laboratory 2017; Gorchov Negron et al. 2023). Because venting is a primary methane source from OCS oil and gas facilities, fewer venting activities could potentially reduce net methane emissions from the proposed action if most of the resulting leases are in water depths greater than 200 m (656 ft). If a facility's alternative to venting is flaring, methane and VOC emissions are reduced but formaldehyde (HAP), NO_x, CO_2, and CO emissions increase (USEPA 2023f).

Table 4.1-5. Comparison of Estimated Methane Emissions for a Single Proposed Oil and Gas Lease Sale (from low to high) When Applying the Projected Production or Projected Activity Scenarios in **Chapter 3.3**.

Water-depth Range	0-60 m	60-200 m	200-800 m	800-1,600 m	1,600+ m
Potential methane emissions (tpy) using projected *production*[1,2]	0-3,810	0-3,822	156-865	93-614	42-317
Potential methane emissions (tpy) using projected *activity levels*[3]	0-463	0-1,021	0-499	0-337	0-390

[1] Emission estimates were based on total facilities amount of methane emissions by water depth from the *Year 2017 Emission Inventory Study* (Wilson et al. 2019a).

[2] Emission estimates were calculated using ongoing production totals (**Table 3.3-1**). For comparison, emissions estimates were also calculated using calendar year 2017 production totals (data not shown), and similar trends were observed.

[3] Projected activity is only based on new facilities and not activity occurring on existing facilities (e.g., tiebacks).

Air Quality-Related Values (AQRVs) on the Breton Wilderness Area: Using the single lease sale scenarios and modeling results from the *Air Quality Modeling in the Gulf of Mexico Region* study (Wilson et al. 2019b), a single lease sale's routine OCS oil- and gas-related sources could contribute about 0.0180 $kg \cdot ha^{-1} \cdot yr^{-1}$ of nitrogen deposition, resulting in **minor** impacts to air quality under existing conditions. Wilson et al. (2019b) made assumptions and estimates that remain suitable for this programmatic impact analysis for a single lease sale. Ozone effects on the Breton Wilderness Area from a single lease sale's OCS oil- and gas-related sources are uncertain because metrics have not been established. However, the secondary O_3 NAAQS (8-hr O_3) does factor effects on vegetation, which was examined above in the CAP section, and concluded that there could be **minor** to **moderate** impacts.

Unintended Releases into the Environment and Response Activities

Air quality can be impacted by unintended releases into the environment and response activities (refer to **Chapter 3.5**) associated with the proposed action. The nature and types of impacts from these events would be the same as those discussed for ongoing OCS oil- and gas-related activities under existing baseline conditions. Depending on the magnitude of an accident(s), the affected air quality should recover with or without remedial action. The majority of oil spills (>95%) that have historically occurred in the GOM have volumes of 1 bbl or less (Anderson et al. 2012). Remedial actions such as scheduled burnings or dispersants would contribute to air emissions, but controlling the activities to happen at certain times would allow responders to minimize any significant degradations to the air quality (National Academies of Sciences, Engineering, and Medicine 2022b). The type of air pollutants emitted would depend on the products. Accidental events would have a **minor** to **moderate** impact across all action alternatives depending on the magnitude of the event and associated response activities. For catastrophic events, refer to the GOM Catastrophic Spill Event Analysis technical report (BOEM 2021c).

Alternatives C and D

Under Alternatives C and D, there would be less acreage available for leasing in shallow water depths (i.e., less than 200 m [656 ft]). Venting is a primary methane source on oil and gas platforms in water depths less than 200 m (656 ft), and **Table 4.1-5** indicates higher estimated methane emissions in shallow-water areas compared to deepwater areas. Therefore, leasing less in shallow water could potentially decrease venting activities and associated methane emissions (refer to Alternative B for a discussion of impacts from methane). If a facility's alternative to venting is flaring, methane and VOC emissions are reduced but formaldehyde (HAP), NO_x, CO_2, and CO emissions increase (USEPA 2023f). Air pollutants can react with each other under different meteorological conditions and form other air pollutants at other temporal and spatial scales, causing increases and decreases in air pollutant concentrations. Though under Alternatives C and D there would be less acreage available for leasing in shallow-water depths, this analysis considers air quality for the entire GOM region, and spatial redistribution of activities with no change in the activity levels (**Chapter 3.3.2**) does not change the potential impacts to the GOM region as a whole.

Overall, the impacts of Alternative C or D to regional air quality would likely be similar to Alternative B because both alternatives would still make substantial areas in shallow waters available for leasing. That said, methane emissions could potentially lessen when compared to Alternative B if leasing under Alternative C or D caused subsequent activity to substantially shift to water depths greater than 200 m (656 ft), where less venting would be anticipated. While it would not change the overall impacts to air quality, if methane emissions were reduced under Alternative C or D, it could lessen the proposed action's net contribution to GHGs and future climate change impacts as discussed in **Chapter 4.0.2.2**.

4.1.3 Incomplete or Unavailable Information

BOEM has identified the following incomplete or unavailable information that may be relevant to reasonably foreseeable impacts on air quality:

- There is limited monitoring data for ambient concentrations of HAPs and GHGs for the region (USEPA 2009; 2023a). However, this would not likely change the impact conclusions since emission inventory reports were used to estimate air emissions for HAPs and GHGs.
- Current conditions of AQRV for ozone effects on the Breton Wilderness Area are unavailable because the FWS has not established metrics for determining

phytotoxic ozone concentrations. However, some protection is provided under the secondary ozone NAAQS (8-hr O_3).

- The *Outer Continental Shelf Air Quality System (OCS AQS): Year 2021 Emissions Inventory Quality Assurance/Quality Control (QA/QC)* study is the most recent available inventory for OCS offshore oil- and gas-related sources in the GOM (Thé et al. 2023). However, the non-platform sources database did not capture all OCS oil- and gas-related sources due primarily to implementation of the updated reporting requirements under BOEM's 2020 Final Rule on Air Quality Control, Reporting, and Compliance (85 FR 34912). Thus, the *Year 2017 Emission Inventory Study* (Wilson et al. 2019a) was used to better account for these non-platform sources (e.g., support vessels) and conservatively capture the full range of potential effects from the proposed action. Though future inventories intend to capture all OCS oil- and gas-related sources for the non-platform sources database, they would not be expected to change the overall conclusions presented in this Programmatic EIS given the conservative nature of the *Year 2017 Emission Inventory Study* and therefore, are not essential to a reasoned choice among alternatives.

BOEM has used the best available scientific information to date and reasonably accepted scientific methodologies to extrapolate from existing information. Therefore, the incomplete or unavailable information above, while relevant, would not likely change the impact conclusions reached in this analysis and is not essential to a reasoned choice among alternatives.

4.2 Water Quality

Water quality refers to the overall health and condition of a water body, taking into consideration its biological, chemical, and physical attributes, as well as its ability to sustain and impact the surrounding ecosystems. Key factors used to assess water quality in coastal and offshore environments include temperature, salinity, dissolved oxygen levels, chlorophyll content, nutrient levels, trace elements (e.g., metals), potential of hydrogen (pH), oxidation-reduction potential (Eh), presence of pathogens, optical properties (i.e., clarity, turbidity, and dissolved/suspended matter), as well as concentrations of contaminants (i.e., heavy metals and hydrocarbons).

4.2.1 Affected Environment

Coastal waters of the GOM include all bays and estuaries from the Rio Grande River to Florida Bay. Coastal water quality ratings in the GOM region ranges from poor to good, with an overall rating of fair (USEPA 2012). The largest contributing inputs 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. Coastal water quality is affected by contaminated sediment, the loss of wetlands, water temperature, salinity, total dissolved solids, suspended solids (turbidity), nutrients, and anthropogenic inputs via runoff, terrestrial point-source discharges, and atmospheric deposition. Refer to Chapter 4.2 of the GOM Oil and Gas SID for more detailed information.

For this analysis, offshore waters include both State waters and the Federal OCS in the Gulf of Mexico. Chapters 3.1 and 3.2 of the GOM Oil and Gas SID describe the physical, geological, oceanographic, and meteorological characteristics of the GOM. Water quality in these areas is influenced by oceanic circulation patterns, which become more substantial farther from shore. These circulation patterns aid in dispersing and diluting anthropogenic contaminants, thereby influencing the water quality. Additionally, sediment quality in the deep GOM and water quality can mutually affect each other, though limited research exists on the interaction between sediment and the ocean in this context.

4.2.2 Environmental Consequences

Water quality in the GOM is affected by existing environmental conditions, natural processes and phenomena, and human-induced factors. Chapter 4.2 of the GOM Oil and Gas SID describes the programmatic concerns influencing water quality. These include major storm events, climate change, harmful algal blooms, and contamination from runoff, which can lead to eutrophication and hypoxia. There are also several OCS oil- and gas-related activities and non-OCS oil- and gas-related activities that have the potential to impact water quality (**Table 4.2-1**). BOEM conducted an initial screening of IPFs in the GOM Oil and Gas SID and determined that discharges and wastes, bottom disturbance, coastal land use/modification, air emissions and pollution, and accidental events (unintended releases into the environment and response activities) could potentially impact water quality. These IPFs and their potential to affect water quality are discussed below and in greater detail in Chapter 4.2.2 of the GOM Oil and Gas SID. Supporting rationale for IPFs that were not analyzed in detail in this Programmatic EIS can also be found in Chapter 4.2.2 of the GOM Oil and Gas SID. New information released since the development of the GOM Oil and Gas SID that is also relevant to the analysis is included in the applicable chapters below.

Table 4.2-1. Impact-Producing Factors with the Potential to Impact Water Quality.

OCS Oil- and Gas-Related Routine Activities	OCS Oil- and Gas-Related Accidental Events	Non-OCS Oil- and Gas-Related Activities
Air Emissions and Pollution	Unintended Releases into the Environment	Air Emissions and Pollution
Discharges and Wastes	Response Activities	Discharges and Wastes
Bottom Disturbance	-	Bottom Disturbance
Coastal Land Use/Modification	-	Coastal Land Use/Modification
-	-	Climate Change
-	-	Natural Processes

There are several existing regulatory programs and requirements that reduce or minimize the environmental effects of these IPFs to water quality in the GOM. Regulatory requirements enforced by BOEM, BSEE, and other agencies are outlined in **Table 4.2-2** and further described in the *Gulf of Mexico OCS Regulatory Framework* technical report (BOEM 2020a). Lessees are required to perform OCS oil- and gas-related activities in accordance with all regulatory requirements; therefore, this analysis factors in the mitigating effects of all applicable regulatory requirements as part of the proposed action when making impact determinations. Though the USEPA primarily regulates discharges from OCS oil- and gas-related activities, BOEM has regulations through its planning process, and BSEE has regulations and compliance responsibilities that also protect against the degradation of the marine environment. Additionally, the USEPA and USCG have regulations that prevent marine degradation from vessels.

Table 4.2-2. Existing Regulatory Requirements and Protective Measures That Reduce the Potential Impacts of Impact-Producing Factors.

Regulatory Requirement or Protective Measure[1]	Enforcing Agency	Impact-Producing Factor(s) Reduced/Avoided	Supporting References and Sections
Post-lease Water Quality Reviews	BOEM, BSEE	Discharges and Wastes	Chapter 5.11 of the GOM Oil and Gas SID
Federal Water Pollution Control Act of 1948, amended in 1972 as the Clean Water Act (CWA)	USEPA	Discharges and Wastes, Bottom Disturbance	Chapters 2.2, 4.2.2, and 5.11 of the GOM Oil and Gas SID
CWA Section 402, the National Pollutant Discharge Elimination System (NPDES) for Regions 4 and 6	USEPA	Discharges and Wastes, Bottom Disturbance	Chapter 3.4.2 of this Programmatic EIS, Chapters 2.2 and 5.11 of the GOM Oil and Gas SID
Vessel Incidental Discharge Act (VIDA) Framework for Incidental Discharges under CWA Section 312(p)	USEPA, USCG	Discharges and Wastes	Chapters 4.2.2.2 and 5.11 of the GOM Oil and Gas SID
BSEE Decommissioning Requirements (30 CFR subpart Q)	BSEE	Discharges and Wastes, Bottom Disturbance	Chapter 4.2.2.2 of the GOM Oil and Gas SID, **Chapter 3** of this Programmatic EIS
BSEE Pollution Prevention (30 CFR § 250.300)	BSEE	Unintended Releases into the Environment	Chapter 5.13 of the GOM Oil and Gas SID

[1] Refer to Chapter 6 of the GOM Oil and Gas SID for conditions of approval commonly applied at the post-lease stage.

4.2.2.1 OCS Oil- and Gas-Related Impact-Producing Factors from Routine Activities

Discharges and Wastes: The primary operational wastes and discharges generated during offshore oil and gas are produced water, drilling fluids, drill cuttings, various waters (e.g., bilge, ballast, fire, and cooling), deck drainage, sanitary wastes, and domestic wastes as described in **Chapter 3.4.2** as well as Chapter 2.2.1 of the GOM Oil and Gas SID. The discharge of routine operational waste streams is regulated by USEPA Regions 4 and 6 in the Gulf of Mexico. Section 402 of the CWA, 33 U.S.C. § 1342, authorizes the USEPA to issue National Pollutant Discharge Elimination System (NPDES) permits allowing discharges on the condition that they will meet certain requirements, including Sections 301, 304, 306, 401 and 403 of the CWA. Discharges are only allowed if the requirements of the CWA and the corresponding NPDES permit are met, including no unreasonable degradation of the environment as discussed in Section 403 of the CWA (BOEM 2020a; USEPA 2022a; 2023b).

According to the USEPA (2022a), effects have been shown to be relatively localized, within 1,000 m (3,281 ft) of the discharge for drilling fluids and cuttings, and within several hundred meters for produced waters. Discharges can transport trace metals, hydrocarbons, and other suspended materials within several acres (Continental Shelf Associates Inc. 2004a) around the drilling location. The potential toxicity of water-based and synthetic-based fluid (SBF) drilling muds are discussed in **Chapter 3.4.2**. A previous study of an SBF spill (Boland et al. 2004) concluded that the released SBF dispersed into the water, settled to the seafloor, and biodegraded. The discharge of SBF-wetted cuttings is allowed under the USEPA Region 4 and Region 6 NPDES general permits, whereas the discharge of muds containing SBF is prohibited. The discharge of drilling muds that meet regulatory criteria but include very low quantities of SBFs have minimal impacts.

Onshore support facilities such as terminals, construction facilities, and processing facilities could produce discharges that affect coastal water quality and are discussed in Chapters 2.2.1.13 and 4.2.2.2 of the GOM Oil and Gas SID. Point-source discharges from these facilities, such as pipe outfalls, would be regulated through compliance with NPDES permits through the USEPA. Non-point sources include rainfall runoff and would be handled through municipal and solid waste facilities, which in turn would be regulated by the USEPA or a USEPA authorized State program to minimize effects.

Vessels may also discharge some wastes to offshore waters. Vessel discharges are regulated through the Vessel Incidental Discharge Act (VIDA), which establishes national standards for discharges incidental to the normal operation of primarily non-military and non-recreational vessels 79 ft (24 m) or greater in length into the waters of the United States or the waters of the contiguous zone. The USCG is tasked with developing implementation, compliance, and enforcement regulations for those standards (USEPA 2023i).

Decommissioning in place of pipelines must be done in accordance with 30 CFR § 250.1751, which includes pigging, flushing, and filling with seawater, unless BSEE waives these requirements. The flushing step can potentially release contaminants into the environment; therefore, the NPDES General Permit for Region 6 requires operators to capture materials from pipelines, umbilicals, and other equipment before disconnection. Pipeline decommissioning could adversely impact water quality if an accidental release occurs during operations.

Bottom Disturbance: Activities resulting in seafloor disturbance are typically localized and short-term in nature. Seafloor disturbances may occur during routine OCS oil- and gas-related activities, including permitted discharges at the seafloor. These disturbances can cause sediment resuspension, temporary release of components (e.g., metals and nutrients) in the sediment, and increased turbidity (Chapter 2.3.1 of the GOM Oil and Gas SID). As a result of these discharges, the highest cutting concentrations are usually in sediments within 328 ft (100 m) of the platform, though some cuttings may be found up to 1.2 mi (2 km) from the discharge point (Continental Shelf Associates Inc. 2006). Overall, these disturbances and impacts on water quality tend to be localized and active only during installation and removal activities. Dislodging of material and sediment resuspension may also occur during decommissioning activities, but all decommissioning activities must follow regulations in 30 CFR § 250.1703, which minimizes this occurrence.

Coastal Land Use/Modification: The construction of onshore infrastructure such as ports, support facilities, construction facilities, and processing facilities to support OCS oil- and gas-related activities may result in coastal land use and modification (**Chapter 3.4.5**), which could increase the potential for erosion, runoff, and turbidity. However, as noted in **Chapter 3.4.5**, existing oil and gas infrastructure is expected to be sufficient to handle development associated with a proposed action. Therefore, impacts to water quality as a result of coastal land use/modification associated directly with a single lease sale would be minimal to undetectable.

Air Emissions and Pollution: Pollution and air emissions from routine OCS oil- and gas-related operations can contribute to acidic deposition, acidification, and eutrophication in the Gulf of Mexico (Caldeira and Wickett 2003; Driscoll et al. 2003a; Paerl et al. 2002; USEPA 2020b; Vitousek et al. 1997; Wanninkhof et al. 2015). However, the extent that these emissions specifically contribute to ocean acidification locally is difficult to constrain (Osborne et al. 2022). This is in part because of the dynamic air and water systems in the Gulf of Mexico that are influenced by multiple factors, including local emissions and inputs from global ocean and air circulation (**Chapter 4.2.2.4**). However, air emissions of pollutants under the National Ambient Air Quality Standards (NAAQS) from OCS oil and gas activities that are known to impact ocean acidification and eutrophication are regulated. Acidic deposition would also contribute to eutrophication, which can induce hypoxia and further lower water pH, causing nutrient enhanced acidification (Glibert 2020; USEPA 2008; 2020b). For a more detailed discussion on air quality and air emissions, refer to **Chapter 4.1**.

4.2.2.2 OCS Oil- and Gas-Related Impact-Producing Factors from Accidental Events

Unintended Releases into the Environment***:*** Oil spills have the greatest potential of all IPFs to affect water quality. **Chapter 3.5.1** discusses past oil spills, historical trends, and a table (**Table 3.5-1**) detailing different oil component groups and their properties and persistence in the environment. Industry practices and government regulations minimize the risk of spills and ensure that industry and government entities are prepared to respond should a spill occur (**Chapter 3.5.2**). However, there is no way to guarantee that spills would not occur. The magnitude and severity of impacts from these events would depend on numerous factors including, but not limited to, spill composition, location, volume, water depth, duration, and weather and oceanographic conditions. However, most spills that occur in the Gulf of Mexico are small (<1,000 bbl), with the majority being <1 bbl. More extensive degradation of water quality could occur from spills >1,000 bbl. At depth, a spill >1,000 bbl could introduce large quantities of oil into the water column, with meteorological and oceanographic conditions having a substantial effect on weathering processes (Alloy et al. 2016; Driskell and Payne 2018; Roberts et al. 2017).

Refer to the GOM Catastrophic Spill Event Analysis technical report (BOEM 2021c) for an assessment of potential impacts resulting from a low-probability catastrophic spill in the GOM similar in nature to the *Deepwater Horizon* oil spill, which is not part of the proposed action. This analysis is separate from the Oil Spill Risk Analysis (OSRA) model used for a single oil and gas lease sale and the Cumulative OCS Oil and Gas Program, which is discussed in the next paragraph. Catastrophic spills, generally 1 million bbl or greater, are extremely rare occurrences that have the potential to cause substantial environmental and socioeconomic harm due to their size, duration, extent, and the necessary response activities. The return period of a catastrophic spill on the scale of the *Deepwater*

Horizon oil spill has been calculated at 165 years across all OCS areas. Stated differently, in any given year the statistical probability of a catastrophic spill of a similar magnitude as the *Deepwater Horizon* oil spill is approximately 0.6 percent (Ji et al. 2014). Therefore, catastrophic events are not considered reasonably foreseeable as part of the proposed action under NEPA.

The OSRA model estimates the combined probabilities of oil spills of spills >1,000 bbl and >10,000 bbl occurring and those spills contacting sensitive resource areas (refer to **Chapter 3.5.1.1**, Oil Spills and Oil-Spill Analysis Summary). As part of the most recent OSRA analysis, BOEM uses oil-spill occurrence rates from ABS Consulting Inc. (2016) and the estimated future volume of oil production as inputs, along with years of oceanographic and meteorological data to model movement of spilled oil in Gulf of Mexico waters (Anderson and LaBelle 2000; Anderson et al. 2012; Ji and Schiff 2023). The occurrence rates in Anderson et al. (2012) show that, in the past, most spills (>95%) have been 1 bbl or less. Small spills (<1,000 bbl) would dissipate quickly through dispersion and weathering (Chapter 4.2.2.3 of the GOM Oil and Gas SID).

Chemical and synthetic-based drilling fluids are commonly used in oil and gas operations. These drilling fluids may also accidentally spill into the environment due to equipment failure, weather (e.g., wind and waves), collisions, and human error; however, the amount of product spilled over time is relatively low (refer to **Chapter 3.5.1**). Oil and gas operations use a variety of other chemicals with common alcohol-based chemicals such as methanol and ethylene glycol used in deepwater operations for the prevention of gas hydrate formation. These exhibit comparatively low toxicity, whereas ammonium chloride and zinc bromide have potential to negatively impact marine life (Chapter 2.9.1.2 of the GOM Oil and Gas SID). Historically, there are only a few, low-volume chemical spills annually, with some years having no chemical spills at all (**Table 3.5-2**). From 2007 to 2014, small chemical spills occurred at an average annual volume of 15.9 bbl, while large chemical spills occurred at an average annual volume of 231.9 bbl (refer to **Chapter 3.5.2**). In general, adverse effects from chemical spills, primarily changes in pH and increased turbidity, are likely to be short-term and localized in impact.

The discharge of trash and debris into the sea or navigable waters of the United States is prohibited under the Water Pollution Control Act, unless processed by a comminutor and able to pass through a 25-mm (1-in) mesh screen. While microplastics in the Gulf of Mexico are an increasing environmental concern (**Chapter 4.2.2.4**), discharges from OCS oil- and gas-related activities are likely not a major contributor (Grace et al. 2022). The BSEE has a marine trash and debris program regulated through 30 CFR § 250.300 with the goal to minimize pollution, including trash and debris. Currently, about 80 percent of the trash and debris found in the ocean are from land-based sources (USEPA 2017). **Chapter 3.5** of this Programmatic EIS and Chapter 2.9.1.7 of the GOM Oil and Gas SID provide more information on trash and debris as an IPF.

Response Activities: Response activities associated with unintended releases, such as the use of dispersants or in-situ burning, may cause short-term impacts to water quality as these can provide other pathways for dissolved and burned hydrocarbons to incorporate into the water column. Nevertheless, chemical dispersants are generally considered the most effective oil-spill response tool when utilized quickly after a spill, and effective use of dispersants in offshore waters deeper than 10 m (33 ft) helps minimize adverse impacts in the water column (National Academies of Sciences, Engineering, and Medicine 2022b). **Chapter 3.5.2** of this Programmatic EIS and Chapter 5.13.3 of the GOM Oil and Gas SID provide an extensive discussion on oil-spill response planning and efforts.

4.2.2.3 Alternatives Analysis

Alternative A – No Action (Cancellation of a Single Proposed OCS Oil and Gas Lease Sale)

Under Alternative A, a proposed OCS oil and gas lease sale would not occur, so there would be no new routine activities or accidental events resulting from the proposed action. Therefore, no direct or indirect impacts to water quality would occur as a result of the proposed action (i.e., a single proposed OCS oil and gas lease sale). However, there are ongoing OCS oil- and gas-related activities and other non-OCS oil- and gas-related activities that contribute to the baseline environment (summarized in **Chapter 4.0.1** of this Programmatic EIS with more detail in Chapter 3 of the GOM Oil and Gas SID) that would still occur. Ongoing activities associated with previous OCS oil and gas lease sales (**Table 3.3-2**) could still have potential direct impacts to water quality through air emissions and pollution, discharges and wastes, bottom disturbance, coastal land use/modification, unintended releases into the environment, and response activities, as summarized above in **Chapter 4.2.2.2** and evaluated as part of the cumulative analysis in **Chapter 4.17.2**.

Comparison of Impacts under Alternatives B, C, and D

A proposed regionwide lease sale under Alternatives B through D, and the resulting OCS oil- and gas-related development on any subsequent leases from the lease sale, would result in discharges and wastes, bottom disturbance, coastal land use/modification, air emissions and pollution, and accidental events that could potentially impact water quality.

Alternative B represents the largest geographic area under consideration for a proposed regionwide OCS oil and gas lease sale. Alternatives C and D represent geographical constraints on available acreage for leasing that could change the spatial distribution of the scenario activities but not their overall activity levels. Therefore, this alternatives analysis is focused on the potential environmental impacts of a regionwide lease sale (Alternative B), and then considers if these potential impacts could be reduced or altered by the geographic constraint under each alternative considered (Alternatives C and D).

Table 4.2-3 shows the impact determinations for each IPF that affects water quality for each action alternative analyzed. The impacts of Alternative A are not shown in **Table 4.2-3** because an oil and gas lease sale would not occur and the impacts for all IPFs would be avoided.

Table 4.2-3. Impact Determinations for Routine and Accidental Impacts to Water Quality for Alternatives B-D.

Impact-Producing Factor	BOEM's Protective Measure[1]	Alternative B	Alternative C	Alternative D
Air Emissions and Pollution	N/A	**Minor** localized	**Minor** localized, **Negligible** in areas excluded from leasing	**Minor** localized, **Negligible** in areas excluded from leasing
Discharges and Wastes	N/A	**Negligible** to **Moderate**	**Negligible** to **Moderate**, **Negligible** in areas excluded from leasing	**Negligible** to **Moderate**, **Negligible** in areas excluded from leasing
Bottom Disturbance	N/A	**Negligible** to **Minor** localized	**Negligible** to **Minor** localized, **Negligible** in areas excluded from leasing	**Negligible** to **Minor** localized, **Negligible** in areas excluded from leasing
Coastal Land Use/Modification	N/A	**Negligible** to **Minor** localized	**Negligible** to **Minor** localized, **Negligible** in areas excluded from leasing	**Negligible** to **Minor** localized, **Negligible** in areas excluded from leasing
Unintended Releases into the Environment	N/A	**Minor** to **Moderate**	**Minor** to **Moderate**, **Negligible** in areas excluded from leasing	**Minor** to **Moderate**, **Negligible** in areas excluded from leasing
Response Activities	N/A	**Negligible**	**Negligible**	**Negligible**

Note: Alternative A is not shown in the table because the impacts from all impact-producing factors would be **none**.

[1] No programmatic protective measures related to water quality for application at the lease sale stage are being contemplated in this Programmatic EIS. All BOEM protective measures for water quality would be considered at the site-specific stage.

Alternative B – Regionwide OCS Lease Sale

Discharges and Wastes: Discharges and wastes would have **negligible** to **moderate** impacts to water quality given the level of routine OCS oil- and gas-related activities from a single oil and gas lease sale (**Table 3.3-2**) that could generate discharges and waste (e.g., exploration, development, and production wells; and vessel trips), and because NPDES permits for Regions 4 and 6 include standards and operator requirements for discharges to minimize impacts to water quality. Impacts on water quality from operational discharges related to a proposed OCS oil and gas lease sale would be minimized because of (1) mandatory compliance with USEPA regulations to prevent unreasonable degradation of the marine environment; (2) prohibitions on discharge of some waste types; (3) prohibitions on discharge near sensitive biological communities; (4) monitoring requirements and toxicity testing; (5) mixing zone, settling, and dilution factors; (6) operational discharges are temporary in nature; and (7) any effects from elevated turbidity that would be short term (due to factors 5 and 6 above), localized (due to factor 5 above), and reversible. According to the USEPA (2022a), effects have been shown to be relatively localized within 1,000 m (3,281 ft) of the discharge for drilling fluids and cuttings and within several hundred meters for produced waters. Therefore, impacts to water quality could be up to **moderate** within 1,000 m (3,281 ft) of discharge points but **negligible** beyond 1,000 m (3,281 ft) given the localized, short-term nature of most routine discharges and compliance with NPDES permit requirements.

Bottom Disturbance: Bottom disturbance would affect water quality close to the seafloor where oil and gas operations occur through resuspended sediments and increased turbidity but are expected to be localized and short-term (due to the same factors 5 and 6 above) while adhering to regulations. Given their localized and short-term nature, along with the routine activities forecasted in **Table 3.3-2** for a single proposed oil and gas lease sale that could lead to bottom disturbance (e.g., structure installation; pipeline installation; structure removal; and exploration, development, and production wells), any impacts are expected to be **negligible** to **minor**.

Coastal Land Use/ Modification: Coastal land use/modification would affect water quality in proximity to where the construction of onshore infrastructure occurs by increasing the potential for turbidity, runoff, and erosion. These impacts would be **negligible** to **minor** given their temporary nature and localized extent (Chapter 4.2.2 of the GOM Oil and Gas SID). Furthermore, existing onshore oil and gas infrastructure and navigation channels are expected to be sufficient to handle development associated with a proposed action. While an oil and gas lease sale and subsequent OCS oil- and gas-related activity would contribute to the continued need for maintenance dredging of existing navigation channels, new navigation channel or onshore infrastructure construction as a direct result of a single OCS oil and gas lease sale is not likely. Federal channels and canals are maintained throughout the relevant onshore area by the USACE, State, county, commercial, and private interests. The USACE is charged with maintaining all larger navigation channels in the area of interest. **Chapter 4.14** discusses potential impacts from the proposed action to land use and coastal infrastructure as a resource.

Air Emissions and Pollution: Air emissions and pollution could affect water quality in the GOM by contributing to acidic deposition, ocean acidification, and eutrophication. Given the level of routine OCS oil- and gas-related activities in **Table 3.3-2** for a single proposed oil and gas lease sale that could generate air emissions and pollution (e.g., G&G surveys, structure installation; pipeline installation; structure removal; vessel trips; and helicopter operations), these impacts are expected to be **minor** because air emissions from the proposed action would be comparatively small and must also comply with all applicable regulations (refer to **Chapter 4.1.2**).

Unintended Releases into the Environment: Under Alternative B, unintended releases into the environment could have **minor** to **moderate** impacts on water quality, depending on the magnitude and severity of the event. Larger volume, longer duration spills would generally result in greater negative impacts to water quality than smaller volume, short duration spills.

Response Activities: Response activities would have **negligible** to **minor** impacts on water quality. Dispersants can have short-term impacts by putting additional hydrocarbons into the dissolved phase, which can still move down the water column and create additional exposure pathways for marine organisms (Chapter 4.2.2.3 of the GOM Oil and Gas SID). Response vessels and aircraft would adhere to operational discharge regulations, but certain response activities such as the use of dispersants could cause a temporary negative impact on water quality.

Therefore, based on the description of the IPFs above and the scenario projections for a single oil and gas lease sale provided in **Chapter 3**, the overall adverse impacts from IPFs associated with Alternative B on water quality would be **negligible** because OCS oil and gas operators must follow regulations to minimize water quality impacts during routine activities, expected impacts would be localized and short-term, historical trends and OSRA analyses show that most spills (>95%) are 1 bbl or less, and any small spills (<1,000 bbl) would dissipate quickly through dispersion and weathering.

Alternative C – Inflation Reduction Act Targeted Lease Sale Area

Alternative C represents a geographical constraint on available acreage for leasing, which could change the spatial distribution of activities compared to Alternative B but not the types of activities or their overall levels. This potential spatial redistribution of activity would not result in a meaningful difference in the overall potential impacts to water quality from routine activities or accidental events when compared to Alternative B. Therefore, the impact conclusions are the same as under Alternative B but with lowered potential for impacts in those areas excluded in the CPA and WPA lease sale areas (refer to **Figure 2.2.3-1**). For these areas, water quality impacts would be **negligible** for all IPFs.

Alternative D – Targeted Lease Sale Area with Additional Exclusions

Alternative D would allow for a proposed lease sale within a substantially smaller geographic area than Alternative C. Additional areas are excluded due to environmental and marine spatial planning considerations. Alternative D would potentially change the spatial distribution of activities compared to Alternative B. As with Alternative C, it would not change the types of activities or their overall levels to a degree that would result in a meaningful difference in the overall impacts from the proposed action to water quality when compared to Alternative B. Therefore, the impact conclusions are the same as under Alternative B but with lowered potential for impacts in those areas excluded (refer to **Figure 2.2.4-1**). For these areas, water quality impacts would be **negligible** for all IPFs.

4.2.3 Incomplete or Unavailable Information

Polluting shipwrecks and chemical weapon disposal areas have the potential to adversely impact water quality. There are an estimated 20,000 potentially polluting shipwrecks in U.S. waters, with 87 identified by NOAA as priority wrecks with individual risk assessments and 13 of those in the Gulf Coast region. The combined worst-case discharge of those 13 wrecks in the Gulf Coast region is approximately 456,000 bbl (NOAA 2013). While substantial, this total amount is comparable to the amount of oil that leaks from natural seeps in the GOM on an annual basis, which is approximately 59,000 metric tonnes/year or 413,000 bbl/year with roughly 7 barrels per metric tonne (National Academies of Sciences, Engineering, and Medicine 2022b; National Research Council 2003b). However, BOEM acknowledges that there is incomplete and unavailable information related to understanding the effects of these shipwrecks, including those that have not been identified as priority by NOAA. Such information, however, is not essential to a reasoned choice among alternatives because there are currently no publicly available data regarding these impacts and because even if more information were available, the overall impacts would not be expected to differ or change across alternatives as a result. This is also the case for climate change, which may have impacts on water quality in the Gulf of Mexico (**Chapter 3.6.3**).

Factors stemming from climate change that could impact water quality are ocean acidification, changing sea-surface temperatures, land-use change, among others; and they may impact water quality in similar ways. For example, stratification and eutrophication may be exacerbated by changing sea-surface temperature or land-use change in response to climate change. However, the extent of these impacts is difficult to predict with the information currently available. Additionally, sediment quality in the deep GOM and water quality can mutually affect each other, though limited research exists on the interaction between sediment and the ocean in this context. Nevertheless, water quality rapidly improves farther from shore (Ward and Tunnell Jr. 2017). The Gulf of Mexico continental shelf/slope and abyssal water quality have and continue to be good, with the exception of hypoxic zones on the continental shelf, waters just above natural oil and gas seeps, and short-term, localized effects near produced-water discharges during OCS oil and gas exploration and production (Ward and Tunnell Jr. 2017). Therefore, the incomplete or unavailable information summarized above, while relevant, would not likely change the impact conclusions reached in this analysis and is not essential to a reasoned choice among alternatives.

4.3 COASTAL COMMUNITIES AND HABITATS

This chapter focuses on the biological aspects of coastal habitats and communities and on the potential effects to these resources from the IPFs described in **Chapter 3**. The potential impacts to human populations and socioeconomic factors associated with these coastal habitats are discussed in subsequent chapters (e.g., recreational resources [**Chapter 4.12**], land use and coastal infrastructure [**Chapter 4.14**], and social factors [**Chapter 4.16**]). The U.S. Gulf of Mexico coastline spans 1,630 mi (2,623 km) from the southern tip of Texas east to the Florida Keys and contains more than 750 bays, estuaries, and sub-estuary systems (USEPA 2012). Coastal habitats considered in this analysis include estuaries, wetlands, mangroves, submerged aquatic vegetation (SAV), beaches and barrier islands, dunes, oyster reefs and coastal coral reefs, extending no farther than the State/Federal water boundary line of the Gulf of Mexico. Saltwater marshes, saltwater mangrove swamps, and nonvegetated areas (e.g., sand bars, mudflats, and shoals) are the most common GOM coastal habitats (Dahl and Stedman 2013). Most of the GOM coastal waters are designated as essential fish habitat, and coastal barrier sand dunes along Alabama and the Florida panhandle contain critical habitat for four subspecies of beach mouse.

4.3.1 Affected Environment

Coastal estuaries provide critical nursery grounds and adult habitat for numerous species of birds, fish, and invertebrates. The SAV, including seagrass beds, provides foraging and nursery habitat for fish and invertebrates, and is important for carbon sequestration, nutrient cycling, and sediment stabilization (Duarte et al. 2004; 2005; Frankovich et al. 2011; Heck Jr. et al. 2003; Orth et al. 2006). Wetlands cycle pollutants and nutrients, trap sediments, minimize erosion, and provide defense against storm surge in coastal areas. Barrier islands protect the mainland from shoreline erosion; act as habitat for birds, crustaceans, and burrowing small mammals (e.g., beach mice); and serve as critical stopover areas for migrating birds (Britton and Morton 1989; Morton 2003; Rosati 2009).

Natural and anthropogenic IPFs (e.g., storms, sea-level rise, land subsidence, and water management measures) have contributed to a long-term trend of wetland loss in the coastal GOM by altering the flow of water, sediments, and nutrients. Climate change has resulted in impacts to coastal habitats, including increased water temperatures, sea-level rise, and greater storm intensity (Bruyère et al. 2017; Sweet et al. 2022; Wang et al. 2023). Storms can result in surge, flooding, and physical damage in coastal areas. Rainfall from storms deliver large amounts of fresh water and nutrients to estuaries and coastal habitats, potentially altering the salinity and chemical conditions (Douglas et al. 2022; Patrick et al. 2020). Excessive nutrient load can lead to eutrophication, resulting in low oxygen or hypoxic conditions. In the GOM, a large band of hypoxic waters occurs annually as a result of excessive nutrient loading from the Mississippi and Atchafalaya Rivers and summertime stratification on the Louisiana-Texas shelf. The hypoxic zone persists until wind-driven circulation mixes the water column and the large spring/summertime riverine inputs subside. Hypoxic conditions can lead to alterations in community structure within coastal habitats by rendering habitat unusable and forcing mobile species to redistribute. For more information on coastal communities and habitats of the GOM, refer to the GOM Oil and Gas SID and Biological Environmental Background Report.

4.3.2 Environmental Consequences

Coastal communities and habitats in the GOM are affected by existing environmental conditions, natural processes and phenomena, and human-induced factors. Chapter 4.3.1 of the GOM Oil and Gas SID describes the programmatic concerns influencing coastal communities and habitats: eutrophication and hypoxia; land loss and sea-level rise; major storm events; ocean acidification; invasive species; and marine trash and debris. There are also several OCS oil- and gas-related activities and non-OCS oil- and gas-related activities that have the potential to impact coastal communities and habitats (**Table 4.3-1**). BOEM conducted an initial screening of IPFs in the GOM Oil and Gas SID and determined that discharges and wastes, bottom disturbance, coastal land use/modification, unintended releases into the environment, and response activities could potentially impact coastal communities and habitats. These IPFs and their potential to affect coastal communities and habitats are discussed below and in greater detail in Chapter 4.3.1 of the GOM Oil and Gas SID. Supporting rationale for IPFs that were not analyzed in detail in this Programmatic EIS can also be found in Chapter 4.3.1 of the GOM Oil and Gas SID. New information released since the development of the GOM Oil and Gas SID and relevant to the analysis is included in the applicable chapters below.

Table 4.3-1. Impact-Producing Factors with the Potential to Impact Coastal Communities and Habitats.

OCS Oil- and Gas-Related Routine Activities	**OCS Oil- and Gas-Related Accidental Events**	**Non-OCS Oil- and Gas-Related Activities**
Discharges and Wastes	Unintended Releases into the Environment	Air Emissions and Pollution
Bottom Disturbance	Response Activities	Discharges and Wastes
Coastal Land Use/ Modification	-	Bottom Disturbance
-	-	Coastal Land Use/Modification
-	-	Climate Change

There are several existing regulatory programs and requirements that reduce or minimize the environmental effects of these IPFs to coastal communities and habitats in the GOM. Regulatory requirements enforced by BOEM, BSEE, and other agencies are included in **Table 4.3-2** and further described in the *Gulf of Mexico OCS Regulatory Framework* technical report (BOEM 2020a). Lessees are required to perform OCS oil- and gas-related activities in accordance with all regulatory requirements; therefore, this analysis factors in the mitigating effects of all applicable regulatory requirements as part of the proposed action when making impact determinations.

Table 4.3-2. Existing Regulatory Requirements and Protective Measures That Reduce the Potential Impacts of Impact-Producing Factors.

Regulatory Requirement or Protective Measure	**Enforcing Agency**	**Impact-Producing Factor(s) Reduced/Avoided**	**Supporting References and Sections**
Clean Water Act (NPDES Permits)	USEPA	Discharges and Wastes	**Chapter 3.4.2** of this Programmatic EIS; Chapter 5.11 of the GOM Oil and Gas SID
Marine Protection, Research, and Sanctuaries Act	USEPA	Discharges and Wastes	33 U.S.C. 1401 § *et seq*.
Pollution Prevention	BSEE	Unintended Releases into the Environment	30 CFR § 250.300 (BSEE)
International Convention for the Prevention of Pollution by Ships (MARPOL 73/78), MARPOL Annex V Treaty	International Maritime Organization (IMO); USCG	Discharges and Wastes; Unintended Releases into the Environment	https://www.dco.uscg.mil/Our-Organization/Assistant-Commandant-for-Prevention-Policy-CG-5P/Inspections-Compliance-CG-5PC-/Commercial-Vessel-Compliance/Domestic-Compliance-Division/MARPOL/; 33 U.S.C. §§ 1901-1915; 33 CFR part 151 subpart A; Chapter 2.9.1.7 of the GOM Oil and Gas SID

Regulatory Requirement or Protective Measure	Enforcing Agency	Impact-Producing Factor(s) Reduced/Avoided	Supporting References and Sections
Ballast Water Management for Control of Nonindigenous Species in Waters of the United States	USCG	Discharges and Wastes	33 CFR part 151 subpart A; Nonindigenous Aquatic Nuisance Prevention and Control Act of 1990 (16 U.S.C. §§ 4701-4751), as amended by the National Invasive Species Act of 1996
Wetland Compensatory Mitigation	USACE; USEPA; State agencies	Bottom Disturbance	Clean Water Act Section 404
Coastal Zone Management Act	NOAA, States	Coastal Land Use/Modification	16 U.S.C. § 1251 and 15 CFR part 930
National Contingency Plan (CWA, Oil Pollution Act, National Oil and Hazardous Substances Pollution Contingency Plan)	USCG; USEPA; State, Regional, and local governments	Unintended Releases into the Environment (accidental oil spill)	40 CFR part 300, Section 311 Clean Water Act; Oil Pollution Act of 1990 (33 U.S.C. § 2701), the National Response Framework, Executive Orders 12580 and 12777, Secretarial Order 3299
Marine Debris Research, Prevention, and Reduction Act	USEPA, USCG	Unintended Releases into the Environment (accidental marine debris)	33 U.S.C. § 1901 *et seq.*; OCS Report BOEM 2020-059, NMFS 2020 BiOp (NMFS 2020b) and amended ITS (NMFS 2021), Appendix B

4.3.2.1 OCS Oil- and Gas-Related Impact-Producing Factors from Routine Activities

Discharges and Wastes: The OCS oil- and gas-related activities in both offshore and onshore waterways result in discharges and wastes (e.g., sanitary wastes, drill muds and cuttings, produced waters, vessel discharges, and ballast). These discharges are regulated by the USEPA through the NPDES general permits in support of the CWA (refer to **Chapter 3.4.1** for more information) as well as the Marine Protection, Research, and Sanctuaries Act (also referred to as the Ocean Dumping Act). Additionally, all vessels in U.S. and international waters are required to adhere to the International Maritime Organization's regulations under the International Convention for the Prevention of Pollution from Ships (MARPOL) limiting discharges, avoiding release of oily water, and prohibiting disposal of solid wastes. Ballast water may carry biological materials such as plants, animals, and microorganisms, which may introduce nonnative species. To prevent the spread of aquatic nuisance species, ballast water is subject to the USCG's Ballast Water Management Program, which implements the provisions of the Nonindigenous Aquatic Nuisance Prevention and Control Act of 1990, as amended by the National Invasive Species Act of 1996. Lessees are required to perform OCS oil- and gas-related activities in accordance with these regulatory requirements, as enforced by the agencies indicated in **Table 4.3-2**.

Most operational discharges such as produced sands, oil-based or synthetic-based drilling muds and cuttings, along with fluids from well treatment, workover, and completion activities, occur offshore and are diluted and discharged according to the USEPA's regulations. While offshore produced-water discharges can extend over 2 km (1 mi) from the source, the majority of the ecological impacts occur within 200-300 m (656-984 ft) of the source (Cordes et al. 2016) and are, in most cases, too distant to pose a threat to coastal communities and habitats. Seepage or discharges from onshore sources such as waste sites, ports, or oil storage sites into adjacent wetland areas can occur, potentially resulting in changes to soil chemical composition and/or vegetation injury or mortality.

***Bottom Disturbance*:** Bottom disturbance from OCS oil- and gas-related activities affecting coastal communities and habitats includes infrastructure and anchor emplacement (including pipeline installation), infrastructure removals, and dredging. Infrastructure emplacement and removal may disturb coastal habitats, resulting in injury or mortality to living habitat-forming organisms such as SAV or marsh grasses. Many existing OCS pipelines made landfall on barrier island and wetland shorelines, and have contributed to land loss in these areas. However, the installation of new pipelines that make landfall is rare (Chapter 3), and modern pipeline installation techniques are less destructive for wetlands than previously used methods. Additionally, these actions would be subject to approval by agencies with regulatory authority (e.g., USACE and State agencies). Mitigation and regulatory measures, such as avoidance or compensatory wetland mitigations, may be applied by those agencies for any new pipeline landfalls. Anchoring may crush or smother SAV, oyster beds, or coastal coral reef habitats.

Dredging of coastal waterways and ports supports, in part, OCS oil- and gas-related activities including the transport of large OCS platforms, other structures, and vessel passage. Dredging may result in the destruction (e.g., crushing and smothering) of coastal benthic habitats such as SAV or oyster reefs. Dredging can also disrupt hydrodynamics, sediment transport, morphology, and ecosystems leading to increased erosion rates, turbidity, land loss, and salinity changes (Boesch et al. 1994; Cox et al. 2022; De Vriend et al. 2011; Jeuken and Wang 2010; Nichols 2018; Onuf 1996; van Maren et al. 2015; Vellinga et al. 2014; Wilber and Clarke 2001). However, these actions would be subject to approval by agencies with regulatory authority (e.g., USACE and State agencies), including mitigation or regulatory measures.

Coastal Land Use/Modification: Onshore construction to support ongoing OCS oil- and gas-related activities (e.g., roads and onshore support bases) can result in alteration or loss of available habitat including wetlands, mangroves, and estuaries. These activities can also increase sediment deposition in wetlands and streams, negatively impacting important habitats such as oyster reefs (e.g., decreased feeding and respiration) and SAV (e.g., smothering and reduced light availability) (Colden and Lipcius 2015; Eisemann et al. 2021). The Coastal Zone Management Act requires that Federal actions be consistent with enforceable policies of a State's federally approved coastal management program. State and Federal permitting agencies discourage the placement and expansion of facilities in wetlands and require mitigation of impacts (e.g., Clean Water Act, USACE's 404 permit, and State permitting programs). Additionally, the GOM has a well-established industrial infrastructure network, and future expansion is expected to be limited (**Chapter 3.4.5**). Vessel activity from OCS oil- and gas-related activities (e.g., tankers and support vessels) can increase wave erosion and habitat loss or degradation in coastal and estuarine habitats, depending on how a particular canal is armored and maintained (Johnston et al. 2009; Robb 2014; Thatcher et al. 2011). Turbidity from wave erosion and salinity changes from vessel-induced saltwater intrusion can also negatively impact water quality in otherwise clear and freshwater bodies.

4.3.2.2 OCS Oil- and Gas-Related Impact-Producing Factors from Accidental Events

Unintended Releases into the Environment: The BSEE requires that lessees take measures to prevent unauthorized discharge of pollutants into offshore waters (30 CFR § 250.300). Additionally, the International Maritime Organization's regulations under the International Convention for the Prevention of Pollution from Ships (MARPOL), the National Contingency Plan, and the Marine Debris Research, Prevention, and Reduction Act contain regulations and guidance to prevent, minimize, and/or respond to accidental pollution from ships. However, accidental releases and spills into the environment from pipelines, platforms, and vessels associated with OCS oil- and gas-related activities may still be caused by large tropical storm events, faulty equipment, or human error. The distance from shore of OCS oil- and gas-related activity in many cases reduces the probability of spilled oil from reaching coastal communities and habitats, as it undergoes weathering and biodegradation before it reaches the coast (OSAT-2 2011). Nonetheless, coastal communities and habitats can be vulnerable to these incidents, particularly from spills resulting from coastal pipeline rupture or vessel accidents (Fischel et al. 1989). Impacts to coastal habitats depend on factors including oil type, volume, and condition, as well as affected habitat characteristics (e.g., permeability of substrate, wave energy, and tidal influence). Oil exposure may result in substantive injury (e.g., reduction in transpiration and carbon fixation) and mortality to wetland vegetation, which may increase coastal habitat vulnerability to erosion. Oil can impact mangroves by coating the breathing surfaces of the roots, killing the plant within days. Chronic exposure to oil can result in defoliation and canopy thinning, leaf yellowing, reduced growth, poor seedling establishment, and mortality (Duke et al. 1997; Hoff and Michel 2014; Lewis et al. 2011). Oil can thicken as its volatile components are degraded and form tar balls or aggregations that incorporate sand, shell, and other materials as it reaches beaches. While SAV can, in some cases, avoid direct contact with spilled oil, other negative effects, such as shading from surface oil, can occur (Erftemeijer and Lewis III 2006; U.S. Navy 2018).

Although vessel and platform operators are required to take preventative measures against the loss of solid waste (e.g., plastic), accidental releases may still occur and pollute coastal habitats. The accumulation of plastic debris on the seafloor can inhibit gas exchange between sediment pore waters and overlying waters (Moore 2008). Plastics can also further breakdown into microplastics, carrying pollutants and heavy metals into coastal environments and negatively impacting the survival and development of filter feeders such as oysters (Craig et al. 2022; Kumar et al. 2021; Moore 2008).

Spill Response: Response activities including physical prevention methods such as booms and barrier berms can cause mortality if they are lifted onto marsh vegetation by wave action. They can also alter hydrology, negatively impacting productivity or causing mortality for certain species of SAV (Frazer et al. 2006; Kenworthy and Fonseca 1996; Zieman et al. 1984). Oiled marshes may incur secondary impacts associated with the cleanup process, such as trampled vegetation, accelerated erosion, and the burying or mixing of oil into marsh soils (Long and Vandermeulen 1983; Mendelssohn et al. 1993; Zengel et al. 2015). Along beaches, cleanup activities can occur where intertidal and supratidal species occur, resulting in crushing and mortality. Offshore *in-situ* burning may result in residue balls that can move inshore and contaminate benthic habitats and shorelines. Burning can also affect air quality for coastal plants (Michel and Rutherford 2013).

4.3.2.3 Alternatives Analysis

Alternative A – No Action (Cancellation of a Single Proposed OCS Oil and Gas Lease Sale)

Under Alternative A, a proposed OCS lease sale would not occur, so there would be no new routine activities or accidental events resulting from the proposed action. Therefore, the direct or indirect impacts to coastal communities and habitats that would occur as a result of the proposed action (i.e., a proposed OCS oil and gas lease sale) are **none**. However, there are ongoing OCS oil- and gas-related activities and other non-OCS oil- and gas-related activities that contribute to the baseline environment (summarized in **Chapter 4.0.1** with more detail in Chapter 3 of the GOM Oil and Gas SID) that also affect coastal communities and habitats and would still occur. Ongoing activities associated with previous OCS oil and gas lease sales (**Table 3.3-2**) could still have potential direct impacts to coastal communities and habitats through discharges and wastes, bottom disturbance, coastal land use/modification, unintended releases into the environment, and response activities. The potential impacts are summarized above in **Chapter 4.3.2.2** and evaluated as part of the cumulative analysis in **Chapter 4.17.3**.

Comparison of Impacts under Alternatives B, C, and D

A proposed regionwide OCS lease sale under Alternatives B through D, and the resulting OCS oil- and gas-related development on any subsequent leases from the proposed OCS oil and gas lease sale, would result in discharges and wastes, bottom disturbance, coastal land use and modification, unintended releases into the environment, and response activities that could potentially impact coastal communities and habitats.

Alternative B represents the largest geographic area under consideration for a proposed regionwide OCS lease sale. Alternatives C and D represent geographical constraints on available acreage for leasing, which could change the spatial distribution of the scenario activities but not their overall activity levels. Therefore, this alternatives analysis is focused on the potential environmental impacts of a proposed regionwide OCS oil and gas lease sale (Alternative B) and then considers if these potential impacts could be reduced by the geographic constraint under each alternative considered (Alternatives C and D).

Table 4.3-3 shows the impact determinations for each IPF that affects coastal communities and habitats for each action alternative analyzed. The impacts of Alternative A are not shown in **Table 4.3-3** because an OCS oil and gas lease sale would not occur and the impacts for all IPFs from the proposed action would be avoided.

Table 4.3-3. Impact Determinations for Routine and Accidental Impacts to Coastal Communities and Habitats for Alternatives B-D.

Impact-Producing Factor	BOEM's Protective Measure[1]	Alternative B	Alternative C	Alternative D
Discharges and Wastes	N/A	**Negligible**	**Negligible**	**Negligible**
Bottom Disturbance	N/A	**Minor**	**Minor**	**Minor**
Coastal Land Use/Modification	N/A	**Minor**	**Minor**	**Minor**
Unintended Releases into the Environment	N/A	**Negligible** to **Moderate**	**Negligible** to **Moderate**	**Negligible** to **Moderate**
Response Activities	N/A	**Negligible** to **Minor**	**Negligible** to **Minor**	**Negligible** to **Minor**

Note: Alternative A is not shown in the table because the impacts from all impact-producing factors is **none**.

[1] No programmatic protective measures for application at the OCS oil and gas lease sale stage are being contemplated in this Programmatic EIS. All BOEM protective measures for coastal communities and habitats would be considered at the site-specific stage.

Alternative B – Regionwide OCS Lease Sale

Alternative B considers a proposed regionwide OCS lease sale area. While estuarine and coastal areas are not included in the proposed OCS lease sale area, impacts from the proposed action may extend to coastal areas due to vessel transit, onshore support, and the connectivity of water bodies. The majority of the EPA is excluded from leasing under this alternative, which greatly reduces or eliminates potential impacts to coastal communities and habitats in the northeastern GOM (e.g., along Florida).

Discharges and Wastes: Discharges and wastes can occur from any routine oil and gas activity except for helicopter operations (**Table 3.3-4**). Given the level of these activities described in **Table 3.3-2** for a single proposed OCS oil and gas lease sale to occur over a 40-year lifespan, impacts from discharges and wastes to coastal communities and habitats are expected to be relatively undetectable and **negligible** due to the applicable regulations described earlier, the likely rapid dispersal of suspended materials via current and wave action, and the fact that most operational discharges occur offshore and are in most cases too distant to pose a threat to coastal communities and habitats.

Bottom Disturbance: Based on the description of the potential impacts above and the expected amount of activity that would cause bottom disturbance in coastal communities and habitats described in **Table 3.3-2**, impacts from bottom disturbance to coastal communities and habitats are expected to be **minor**. The anticipated amount of pipeline landfalls is extremely low and the amount of dredging activity (likely maintenance) that would be attributed to a proposed action is relatively small (refer to **Chapter 3**). Impacts to habitat quality are expected to be highly localized in areas already used in the OCS oil and gas industry.

Coastal Land Use/Modification: Impacts from coastal land use/modification to coastal communities and habitats are expected to be **minor**, as onshore industrial infrastructure is already largely in place (including support and helicopter bases). However, the relative amount of added vessel traffic from service vessels and pipeline installation (**Table 3.3-2**) could result in adverse localized impacts to habitat quality and extent from erosion.

Unintended Releases into the Environment: Impacts from unintended releases into the environment to coastal communities and habitats are expected to be **negligible** to **moderate**. Impacts from trash and marine debris (including plastics) tied to a single proposed OCS oil and gas lease sale would be largely undetectable and negligible. Non-oil spills (e.g., chemical spills and synthetic-based fluid spills) would likely be relatively infrequent based on the occurrences of these accidental spills calculated over the past decade (**Tables 3.5-2 and 3.5-3**). These spills could also disperse before reaching coastal habitats due to wind and wave action. Based on the number and volume of accidental oil spills estimated for a single proposed OCS oil and gas lease sale (**Chapter 3**), negative impacts to coastal communities and habitats could range from undetectable for small spills or spills occurring farther offshore (potential for oil to weather and biodegrade before reaching shore), to notable, localized impacts for larger spills or spills occurring nearshore. For information regarding catastrophic oil spills, which are not reasonably forseeable under a proposed action, refer to the GOM Catastrophic Spill Event Analysis technical report (BOEM 2021c).

Spill Response: Similarly, impacts from spill response to coastal communities would depend on the spill size and vicinity to coastal habitat. These impacts are expected to be **negligible** to **minor**. No spill response activities may be necessary if accidental spills are small or if they occur far enough offshore and weather before reaching coastal habitats. Spill-response methods such as booms deployed offshore would also have no effect on coastal habitats. Highly localized impacts to coastal communities as described earlier may occur in the case of nearshore spills or if spills are of magnitude to reach the coastline from offshore sources and necessitate nearshore cleanup methods.

Therefore, based on the description of the IPFs above and the scenario projections for a single proposed OCS oil and gas lease sale provided in **Chapter 3**, the overall impacts from IPFs associated with Alternative B on coastal communities and habitats would be **negligible** to **moderate**.

Alternative C – Inflation Reduction Act Targeted OCS Lease Sale Area

The potential spatial redistribution of activity under Alternative C would not change impact conclusions for coastal communities and habitats from those under Alternative B. Whole and partial SSRA blocks and whole and partial blocks proposed to be subject to the Blocks South of Baldwin County, Alabama, Stipulation are removed from potential leasing under this alternative. This may result in fewer activities in the vicinity of adjacent coastal communities and habitats, further decreasing the potential for offshore spills to reach coastal habitats. The need for coastal spill response from offshore spills may be correspondingly less likely. However, spills from vessels and pipelines in coastal areas may still occur. Therefore, these area exclusions do not change the overall suite of IPFs and impact conclusions from Alternative B.

Therefore, based on the description of the IPFs above and the scenario projections for a single proposed OCS oil and gas lease sale provided in **Chapter 3**, the overall impacts from IPFs associated with Alternative C on coastal communities and habitats would be **negligible** to **moderate**.

Alternative D – Targeted OCS Lease Sale Area with Additional Exclusions

The potential spatial redistribution of activity under Alternative D would not change impact conclusions for coastal communities and habitats from those under Alternative B or C. In addition to the exclusions under Alternative C, Alternative D would additionally remove from leasing consideration whole and partial blocks in coastal OCS waters shoreward of the 20-m (66-ft) isobath. This may result in even fewer activities in the vicinity of adjacent coastal communities and habitats, further decreasing the potential for offshore spills to reach coastal habitats. The need for coastal spill response from offshore spills may be correspondingly less likely. However, spills from vessels and pipelines in coastal areas may still occur. Therefore, this area exclusion does not change the overall suite of IPFs and impact conclusions from Alternative C or D.

Therefore, based on the description of the IPFs above and the scenario projections for a single proposed OCS oil and gas lease sale provided in **Chapter 3**, the overall impacts from IPFs associated with Alternative D on coastal communities and habitats would be **negligible** to **moderate**.

4.3.3 Incomplete or Unavailable Information

BOEM has identified incomplete or unavailable information that may be relevant to reasonably foreseeable impacts on coastal communities and habitats. Projections of relative sea-level rise are uncertain; therefore, future impacts to northern GOM ecosystems are unknown beyond predictions based on models and trends. Similarly, determining the effects of ocean acidification in the northern GOM is challenging since it receives large freshwater and nutrient influxes that enhance carbonate chemistry variability (Osborne et al. 2022). Future rates of coastal development are also unknown. There are unknowns regarding future planned restoration efforts, such as what specific projects would ultimately be constructed and their success. Although additional information on these IPFs may be relevant to the evaluation of impacts to coastal communities and habitats, BOEM has determined that such information is not essential to a reasoned choice among alternatives. Existing projections of sea-level rise and other climate change-induced impacts provide sufficient information about the types and general estimated intensity of impacts anticipated. Additionally, future coastal development and restoration efforts would be expected to result in mainly localized effects. BOEM used the best available science to determine the range of reasonably foreseeable impacts and applied accepted scientific methodologies to integrate existing information and extrapolate potential outcomes in completing this analysis and formulating the conclusions presented here.

4.4 Benthic Communities and Habitats (including protected corals)

Benthic fauna inhabit the seafloor throughout the Gulf of Mexico at all water depths. Benthic organisms interact with seafloor sediment through bioturbation, oxygenation, and cementation of the sediments. Microbial communities and, within the photic zone, microalgae, macroalgae, and rooted vegetation also inhabit the seafloor. All benthic communities are trophically linked and contribute substantially to global carbon cycling.

Naturally occurring geological (exposed bedrock) or biogenic (authigenic carbonate relict reef) seafloor with measurable vertical relief serves as important habitat for a wide variety of sessile and mobile marine organisms in the GOM. Encrusting algae and sessile invertebrates such as corals, sponges, sea fans, sea whips, hydroids, anemones, ascidians, and bryozoans may recruit to and colonize these hard substrates, creating "live bottom" (Cummins Jr. et al. 1962). Corals and large sponges function as structural architects, adding complexity to the benthic habitat.

Elkhorn (*Acropora palmata*), staghorn (*Acropora cervicornis*), boulder star (*Orbicella franksi*), lobed star (*Orbicella annularis*), mountainous star (*Orbicella faveolata*), rough cactus (*Mycetophyllia ferox*), and pillar (*Dendrogyra cylindrus*) corals are listed under the Endangered Species Act (ESA) as threatened due to the decrease in their population sizes. Distribution of those listed species within the U.S. Exclusive Economic Zone ranges from the State of Florida to the Flower Garden Banks National Marine Sanctuary and the U.S. territories of Puerto Rico, U.S. Virgin Islands, and Navassa Island. Critical habitat was designated for the elkhorn and staghorn coral species by NMFS in 2008 and includes four counties in Florida (i.e., Palm Beach, Broward, Miami-Dade, and Monroe Counties) (73 FR 72210). In September 2023, NMFS designated critical habitat for five threatened Caribbean coral species (e.g., *Orbicella annularis, O. faveolata, O. franksi, Dendrogyra cylindrus,* and *Mycetophyllia ferox*) pursuant to Section 4 of the ESA (88 FR 54026). Twenty-eight mostly overlapping areas within the species' ranges in Florida, Puerto Rico, the U.S. Virgin Islands, Navassa Island, and the Flower Gardens Banks National Marine Sanctuary (FGBNMS) were identified to contain the essential features essential for the reproduction, recruitment, growth, and maturation of the listed corals. *Orbicella annularis, O. faveolata, and O. franksi* are found within the designated critical habitat within the FGBNMS.

4.4.1 Affected Environment

Benthic fauna inhabit the seafloor throughout the GOM at all water depths. Documented benthic ecosystems in the GOM include muddy, soft bottom; oyster reefs; coral and sponge dominant banks (shallow and mesophotic topographic features, e.g., the Flower Garden Banks, Pinnacle Trend features, the South Texas Banks, and low-relief features in the eastern GOM); hydrocarbon seeps along the continental margin; and marine canyons, escarpments, and seamounts on the abyssal plain (Briones 2004). Connectivity with areas adjacent to and within the GOM depends on pelagic larval transport by surface currents. Most GOM hard bottom benthic communities are diverse and characterized by high species richness and low abundance, while soft bottom communities are characterized by low species richness and high abundance. Suspension feeders are generally most abundant in high-energy environments, and deposit feeders are most abundant in low-energy environments in areas with fine-grained, muddy sediments (Snelgrove 1999). For more detail, refer to Chapter 3.4 of the Biological Environmental Background Report (BOEM 2021b). The analysis for this Programmatic EIS will focus on the hard bottom communities due to the ubiquitousness of soft bottom in the GOM.

The GOM shallow-water coral reefs occupy roughly 1,019 mi^2 (2,640 km^2) of the entire GOM (<0.2% of the area), with the largest distribution along the Florida coast (Tunnell Jr. et al. 2007). Coral reefs provide key ecosystem functions, including coastal protection from storms and erosion, habitat, and spawning and nursery grounds for numerous fishes, as well as human ecosystem functions like tourism, fishing, and recreation. For more detail, refer to Chapter 3.2.6 of the Biological Environmental Background Report (BOEM 2021b).

Staghorn, rough cactus, and pillar corals are not considered in this analysis as their distributions do not overlap any areas that may be offered in the GOM under Alternatives A-D and are too distant to be reasonably affected by routine activities or accidental events occurring in the potential lease areas included in Alternatives A-D. Only ESA-listed corals and designated coral critical habitat located within the midshelf and shelf-edge topographic features, all of which are located within the FGBNMS, are considered in this analysis.

4.4.2 Environmental Consequences

Benthic communities and habitats, including protected corals (i.e., ESA-listed corals and designated coral critical habitat), in the GOM are affected by existing environmental conditions, natural processes and phenomena, and human-induced factors. Chapter 4.3.2.1 of the GOM Oil and Gas SID and Chapter 4 of the Biological Environmental Background Report (BOEM 2021b) describe the programmatic concerns influencing benthic communities and habitats including: fishing pressure (i.e., bottom disturbance) and climate change-related effects including ocean acidification, rise in water temperature, changes in circulation patterns, changes in water chemistry, increased storm activity, sea-level rise, and habitat modification or loss. In August 2022, disease-like lesions were reported on seven stony coral species within the Flower Garden Banks National Marine Sanctuary on the East and West Flower Garden Banks. During the Sanctuary's rapid response cruises, lesions and tissue loss were observed associated with fish and invertebrate predation. It is currently unknown if this disease is Stony Coral Tissue Loss Disease, a type of white plague, or other disease, and transmission factors are undetermined. Monitoring of disease progression and response to treatment is ongoing (Johnston et al. 2023). It is also unknown if this disease has spread to other benthic communities within the GOM.

In addition to programmatic concerns, there are several OCS oil- and gas-related activities and non-OCS oil- and gas-related activities that have the potential to impact benthic communities and habitats, including protected corals (refer to **Table 4.4-1**). BOEM conducted an initial screening of IPFs in the GOM Oil and Gas SID and determined that OCS oil- and gas-related discharges and wastes, bottom disturbance, offshore habitat modification/space-use, unintended releases into the environment, response activities, and strikes and collisions could potentially impact benthic communities and habitats, including protected corals. These IPFs and their potential to affect benthic communities and habitats and protected corals are discussed below and in greater detail in Chapters 4.3.2 of the GOM Oil and Gas SID and Chapter 4.4 of the Biological Environmental Background Report (BOEM 2021b). Their potential influence on benthic communities and habitats, including protected corals, is described in **Chapter 4.17.4**. Noise and lighting and visual impacts from both OCS-oil- and gas-related activities and non-OCS oil- and gas-related activities were initially identified in the GOM Oil and Gas SID as IPFs that could affect benthic communities and habitats. For both noise and lighting and visual impacts, any impact is expected to be small and localized, and recovery would occur without remedial or mitigating action. Therefore, those two IPFs have been scoped out of this analysis due to the relative size and scope of this proposed action in comparison to the potential cumulative impacts of those IPFs (i.e., small) on benthic communities and habitats, including protected corals (BOEM 2021b). Additional supporting rationale for the IPFs that were not analyzed in detail in this Programmatic EIS can be found in Chapters 4.3.2.2.1 and 4.3.2.2.2 of the GOM Oil and Gas SID.

Table 4.4-1. Impact-Producing Factors with the Potential to Impact Benthic Communities and Habitats and Protected Corals.

OCS Oil- and Gas-Related Routine Activities	**OCS Oil- and Gas-Related Accidental Events**	**Non-OCS Oil- and Gas-Related Activities**
Bottom Disturbance	Unintended Releases into the Environment	Bottom Disturbance
Discharges and Wastes	Response Activities	Discharges and Wastes
Offshore Habitat Modification/ Space Use	Strikes and Collisions	Offshore Habitat Modification/ Space Use
-	-	Climate Change

Generally, ESA-listed corals may experience the same types of potential IPFs from OCS oil- and gas-related activities as other coral species inhabiting live bottom (shallow-water) habitats. Given their low or declining populations, however, the relative impacts from OCS oil- and gas-related activities on a particular group of ESA-listed coral colonies could be disproportionately higher than on other non-listed coral species. BOEM, therefore, consults with NMFS to minimize any potential impacts to these species (refer to the 2020 BiOp) (NMFS 2020b). New information released since the development of the GOM Oil and Gas SID and relevant to the analysis is included in the applicable chapters below.

There are several existing regulatory programs and requirements that reduce or minimize the environmental effects of these IPFs to benthic communities and habitats, including protected corals, in the GOM. The stipulations and mitigating conditions of approval, as well as regulations provided in the National Marine Sanctuaries Act for the Flower Garden Banks National Marine Sanctuary listed in **Table 4.4-2** all reduce impacts to sensitive benthic communities by not allowing bottom-disturbing activities within No Activity Zones of topographic features and by distancing bottom-disturbing activity from sensitive benthic habitat to prevent physical disturbance and sedimentation on the habitat. The avoidance measures required through BOEM lease stipulations and conditions of plan approval are generally referenced as “avoidance and distancing requirements for bottom-disturbing activities” henceforth for simplicity.

Unintended releases into the environment of marine debris, and in particular plastic pollution, can be reduced through regulations such as the Marine Debris Research, Prevention, and Reduction Act, the Marine Plastic Pollution Research and Control Act, and the Marine Debris Research, Prevention, and Reduction Act and impacts from discharges and wastes can be reduced by regulatory requirements including the NPDES Permit and the MARPOL Annex V Treaty. Additionally, impacts to benthic communities and habitat may generally be mitigated through the preparedness of the National Contingency Plan.

Lessees are required to perform OCS oil- and gas-related activities in accordance with all regulatory requirements and applicable lease stipulations as outlined in **Table 4.4-2** and enforced by BOEM, BSEE, and other agencies. Therefore, this analysis factors in the mitigating effects of all applicable regulatory requirements as part of the proposed action when making impact determinations.

Table 4.4-2. Existing Regulatory Requirements and Protective Measures That Reduce the Potential Impacts of Impact-Producing Factors.

Regulatory Requirement or Mitigating Measure[1]	Enforcing Agency	Impact-Producing Factor(s) Reduced/Avoided	Supporting References and Sections
Topographic Features Stipulation	BOEM	Bottom Disturbance, Discharges and Wastes, Response Activities	NTL No. 2009-G39, Biologically-Sensitive Underwater Features and Areas; Chapters 5.10 and 7.6 of the GOM Oil and Gas SID
Live Bottom (Pinnacle Trend) Stipulation	BOEM	Bottom Disturbance, Discharges and Wastes, Response Activities	NTL No. 2009-G39, Biologically-Sensitive Underwater Features and Areas; Chapters 5.10 and 7.9 of the GOM Oil and Gas SID
Hard Bottom Habitat and Chemosynthetic Communities Avoidance Mitigations	BOEM	Bottom Disturbance, Discharges and Wastes, Response Activities	NTL No. 2009-G39, Biologically-Sensitive Underwater Features and Areas; NTL No. 2009-G40, Deepwater Benthic Communities; Chapters 5.10, 6, and 7.9 of the GOM Oil and Gas SID
Marine Plastic Pollution Research and Control Act	USCG	Unintended Releases into the Environment (accidental marine debris)	33 U.S.C. § 1901; OCS Report BOEM 2020-059; 2020 NMFS BiOp (NMFS 2020b) and amended ITS (NMFS 2021), Appendix B
Magnuson–Stevens Fishery Conservation and Management Act (Essential Fish Habitat Consultation)	NOAA	Bottom Disturbance; Noise; Discharges and Wastes; Unintended Releases into the Environment	50 CFR part 600
National Contingency Plan (CWA, Oil Pollution Act, National Oil and Hazardous Substances Pollution Contingency Plan)	USCG; USEPA; State, Regional, and local governments	Unintended Releases into the Environment (accidental oil spill and spill response)	40 CFR part 300, Section 311 Clean Water Act; Oil Pollution Act of 1990 (33 U.S.C. § 2701), the National Response Framework, Executive Orders 12580 and 12777, Secretarial Order 3299

Regulatory Requirement or Mitigating Measure[1]	Enforcing Agency	Impact-Producing Factor(s) Reduced/Avoided	Supporting References and Sections
Marine Debris Research, Prevention, and Reduction Act	USEPA, USCG	Unintended Releases into the Environment (accidental marine debris)	33 U.S.C. § 1901; OCS Report BOEM 2020-059, NMFS 2020 BiOp (NMFS 2020b) and amended ITS (NMFS 2021), Appendix B
Clean Water Act Section 402, the National Pollutant Discharge Elimination System (NPDES) for Regions 4 and 6	USEPA	Discharges and Wastes	**Chapter 3.4.2** of this Programmatic EIS; Chapters 2.2 and 5.11 of the GOM Oil and Gas SID
International Convention for the Prevention of Pollution by Ships (MARPOL 73/78), MARPOL Annex V Treaty	International Maritime Organization (IMO); USCG	Discharges and Wastes; Unintended Releases into the Environment	https://www.dco.uscg.mil/Our-Organization/Assistant-Commandant-for-Prevention-Policy-CG-5P/Inspections-Compliance-CG-5PC-/Commercial-Vessel-Compliance/Domestic-Compliance-Division/MARPOL/; 33 U.S.C. §§ 1901-1915; 33 CFR part 151 subpart A; Chapter 2.9.1.7 of the GOM Oil and Gas SID
Marine Protection, Research, and Sanctuaries Act	USEPA	Discharges and Wastes; Unintended Releases into the Environment	33 § U.S.C. 1401 *et seq.*
National Marine Sanctuaries Act – Flower Garden Banks National Marine Sanctuary, including NMSA 304(d)	NOAA	Bottom Disturbance	15 CFR part 922 subpart L; 16 § U.S.C. 1434(d)

[1] Refer to Chapter 6 of the GOM Oil and Gas SID for conditions of approval commonly applied at the post-lease stage.

4.4.2.1 OCS Oil- and Gas-Related Impact-Producing Factors from Routine Activities

Bottom Disturbance: Physical disturbance of the seafloor from OCS oil- and gas-related activities may result in the destruction of sessile benthic organisms and hard bottom and/or chemosynthetic habitat and soft sediment turbation. Impacts that cause bottom disturbance may be temporary (e.g., anchoring) or more persistent within the environment (e.g., platform or pipeline installation). Potential effects from bottom disturbance may include crushing of hard substrates and structure-forming organisms including corals and sponges, burial of organisms, and scarring of the seafloor. The spatial extent of the seafloor disturbance would depend on the specific activity, local environmental conditions, physical regime (e.g., water depth, bottom currents, light penetration, etc.), and local habitat and community composition, extent, and health. The degree of impact and recovery potential depends on the type of hard bottom habitat (i.e., topographic features, pinnacles, low-relief features, cold seeps, brine pools, etc.), individual feature size and surface area, distance between features, community structure, species richness, organism density, and other attributes coupled with the spatial extent and duration of the bottom disturbance. Anthropogenic bottom disturbance is often sufficient to cause loss of species diversity within benthic communities, particularly in the deep sea (summarized in Jones et al. 2006).

Increased turbidity resulting from seafloor disturbance can reduce feeding efficiency and clog filter-feeding structures of hard-substrate organisms, and decrease larval settlement success (summarized in Lissner et al. 1991). The impact to filter feeders from bottom disturbance and sediment suspension may result in preferential recolonization by epibenthic deposit feeders, resulting in an overall change of species composition (Jones et al. 2006). Sessile and mobile invertebrate species adapted to living in turbid environments, such as several tall and flexible gorgonian species, may be less affected by increased turbidity. Reduction in available geological or biogenic substrate may also have secondary ecological effects on organisms that use complex structural microhabitats to, for example, lay eggs (Etnoyer and Warrenchuk 2007; Shea et al. 2018).

BOEM requires protective measures through lease stipulations, post-lease mitigations, and through EFH consultation to minimize and avoid impacts from bottom-disturbing activities to protect sensitive, slow-to-recover hard bottom habitats. These distancing mitigations, enforced by BSEE, ensure that bottom-disturbing activity is sufficiently distanced from sensitive benthic habitat, including ESA-listed corals and designated coral critical habitat, to prevent most impacts. These mitigations reduce the potential for sensitive, hard bottom habitats to be negatively impacted by disallowing destruction of hard bottom features and distancing turbidity and sedimentation effects. Depending on the location of the proposed activities, a National Marine Sanctuary Act (NMSA) consultation may be required and could result in additional mitigations for hard bottom habitat (e.g., further distancing requirements). Bottom disturbance is not mitigated for soft bottoms, and damage to these habitats may still occur. However, soft bottom communities are far more common in the GOM and generally recover relatively quickly (3 months to 2.5 years) in comparison to hard bottom communities (8-10 or more years) (Brooks et al. 2006; Rogers and Garrison 2001; Tamsett et al. 2010; Wilber and Clarke 2007). Without the application of BOEM mitigating measures, there is the potential for bottom disturbance to cause crushing, turbidity, and sedimentation to sensitive benthic organisms.

Discharges and Wastes: The spatial footprint of discharge varies with discharge volume, water depth, local hydrography, sediment particle size distribution, settlement rate, floc formation, and time (Neff 2005; Niu et al. 2009). Discharges from OCS oil- and gas-related activities are subject to regulatory requirements such as the NPDES permitting process, MARPOL Annex V Treaty, and others (**Table 4.4-2**). Enforcement of the relevant laws and regulations is conducted by several Federal agencies, including the USEPA, NOAA, BSEE, and USCG lessees are required to perform OCS oil- and gas-related activities in accordance with these regulatory requirements.

Operational discharges from drilling (i.e., muds and cuttings) discharged at the sea surface tend to disperse in the water column and be distributed at low concentrations (Continental Shelf Associates Inc. 2004a). In deep water, most cuttings discharged at the sea surface are likely to be deposited within 250 m (820 ft) of a well (Continental Shelf Associates Inc. 2006), although ecological changes have been observed within 300 m (984 ft) and up to 1-2 km (0.6-1.2 mi) for especially sensitive species (summarized in Cordes et al. 2016). Cuttings shunted to the seafloor form sediment piles with a generally smaller surface area than those formed from sea-surface discharge (Neff 2005). Mud and cuttings can bury and/or smother benthic habitat and associated organisms. Habitats and organisms most vulnerable are those in low-energy environments within a few hundred meters of a wellsite. Cuttings may form resistant mounds on which distinctive fauna characterized by mobile predators may develop (Lissner et al. 1991). The vulnerability of sessile organisms to impacts from drilling discharges is directly related to levels of suspended solids and the organisms' ability to clear particles from feeding and respiratory surfaces (Rogers 1990). Coverage with discharged sediments as low as 3 mm (0.12 in) can cause detectable impacts to infauna (Schaanning et al. 2008).

The chemical content of drilling muds and cuttings, and to a lesser extent produced waters, may contain hydrocarbons, trace metals including heavy metals, elemental sulphur, and radionuclides (Kendall and Rainey 1991; Trefry et al. 1995). Undiluted heavy metals and toxic compounds have the potential to be moderately toxic to benthic organisms (Continental Shelf Associates Inc. 2004b). Produced waters dilute rapidly with distance from the source; impacts are generally only observed within very close proximity to the source (Gittings et al. 1992; Neff 2005). The exposure of warm-water coral species to drilling fluid may result in reduced viability, morphological changes, altered feeding behavior, altered physiology, or disruption to the pattern of polyp expansion (summarized in Freiwald et al. 2004).

BOEM distances OCS oil- and gas-related well drilling activities from sensitive hard bottom benthic habitat, including protected corals, through stipulations attached to leases or mitigations attached as conditions of approval for permitted activities (**Table 4.4-2**). The distancing requirements separate the heaviest concentration of discharges from benthic habitat. For specific topographic features, variably sized concentric zones are established surrounding the topographic feature's No Activity Zone, which requires that drill cuttings and drilling fluids are shunted to near the seafloor to avoid discharge on sensitive benthic habitat. With the application of these BOEM protective measures, the impacts to benthic communities and habitats, including protected corals, would be reduced because bottom-disturbing activity and associated discharges would be sufficiently distanced from sensitive benthic habitat to prevent most impacts. Without the application of BOEM mitigating measures, the discharges and wastes could bury or smother benthic communities and habitats, including protected corals.

Offshore Habitat Modification/Space Use: Sessile benthic organisms commonly associated with OCS oil and gas structures (e.g., rigs) are influenced by the presence of these structures. The ESA-listed coral species are not associated with OCS oil and gas platforms or artificial reefs in the GOM; however, the presence of these structures have the potential to modify the benthic habitat and the overall community structure of which they are an integrated part. Microalgae and nearly all invertebrate taxa (i.e., corals, anemones, hydroids, sponges, bivalves, mollusks, and polychaetes) have been observed on artificial substrates and reefs (Macreadie et al. 2011). Communities that develop on artificial substrate are often different than those on natural reefs (Burt et al. 2009). Over long distances, operating platforms, exposed pipelines, and reefs may act as "stepping stones" across areas with little to no natural hard substrate that act to increase connectivity with biogeographical consequences (summarized in Cordes et al. 2016; Redford et al. 2021; Rouse et al. 2019). A change in a species' spatial distribution may have potential long-term effects related to dispersal and genetic connectivity to other populations of said species.

Offshore oil and gas platforms are also a known vector for the movement of non-native and invasive species (Bax et al. 2003; Simons et al. 2016). In the GOM, the most common introduced benthic species are the cup coral *Tubastraea* sp., mussels, and a diademnid ascidian. Mussels have the greatest impact through fouling, clogging, competition with indigenous species, and disease transfer. *T. coccinea*, originally from the Pacific Ocean, is considered an invasive species in the GOM and prefers artificial to natural substrates; however, at this time, it does not appear to threaten natural coral communities (Kolian et al. 2017).

There are no specific BOEM-applied OCS oil- and gas-related mitigating measures for benthic communities and habitats associated with offshore habitat modification/space use. However, distancing requirements related to mitigating bottom-disturbance impacts, as required in BOEM lease stipulations and post-lease mitigations (**Table 4.4-2**), would distance activities associated with offshore habitat modification/space use from sensitive benthic habitat and, therefore, could mitigate its potential impacts.

4.4.2.2 OCS Oil- and Gas-Related Impact-Producing Factors from Accidental Events

Unintended Releases into the Environment: While laws and regulations exist to prevent unauthorized discharge of pollutants into offshore waters (**Table 4.4-2**), accidental releases and spills into the environment from OCS oil- and gas-related activities may still be caused by large tropical storm events, faulty equipment, or human error. Accidental marine debris release has the potential to cause impacts to benthic communities, including protected corals, similar to those described earlier for bottom disturbance (e.g., crushing of hard substrates and structure-forming organisms including corals and sponges, burial of organisms, and scarring of the seafloor).

Most spills are small (<1,000 bbl), and a localized impact from one non-catastrophic accidental event would only impact a small portion of the overall resource population in the GOM (i.e., a small number of individual organisms). The vulnerability of benthic habitats to an accidental release of oil or other contaminants from a surface vessel, well, pipeline, etc. would depend on the combination of several components: spill location (surface or subsurface); spill volume; and applied spill-response methods (e.g., dispersant use). For any accidental spill, it is expected that a certain quantity of oil may eventually settle on the seafloor through a binding process with suspended sediment particles (adsorption) or after being consumed and excreted by phytoplankton (Passow et al. 2012; Valentine et al. 2014). For most oil spills, the proportion of oil that may reach the benthos is small; however, it is expected that the greatest amount of adsorbed oil particles would occur close to the spill, with the concentrations reducing over distance. If a large spill does occur close to a benthic habitat, some of the organisms may become smothered by settling particles and/or other sediments and experience long-term exposure to hydrocarbons and/or oil-dispersant mixtures that could persist within the sediments (Fisher et al. 2014; Hsing et al. 2013; Valentine et al. 2014). Localized impacts may include reduced recruitment success, reduced growth, and reduced biological cover as a result of impaired recruitment (Kushmaro et al. 1997; Rogers 1990). Sublethal effects that may occur to benthic organisms exposed to oil or dispersants may include reduced feeding, reduced reproduction and growth, physical tissue damage, and altered behavior.

If an oil spill occurs at depth in deep water and the oil is ejected under pressure, some oil would rise to the surface, but some oil droplets may become entrained deep in the water column (Boehm and Fiest 1982), creating a subsurface plume (Adcroft et al. 2010). If this plume were to encounter benthic habitat and organisms, the impacts could be severe. Consequences may include mortality, loss of habitat, reduced biodiversity, reduced live bottom coverage, changes in community structure, and reduced reproductive success (Guzmán and Holst 1993; Negri and Heyward 2000; Reimer 1975; Silva et al. 2016). The extent and severity of impacts would depend on the location and weathering of the oil and the hydrographic characteristics of the area (Bright et al. 1978; Le Hénaff et al. 2012; McGrail 1982; Rezak et al. 1983). If dispersants are applied to a subsurface plume, any dispersed oil in the water column that comes into contact with corals may evoke short-term negative responses, including reduced feeding and photosynthesis or altered behavior (Cook and Knap 1983; Dodge et al. 1984; Ross and Hallock 2014; Wyers et al. 1986). While subsurface plumes of oil have been theoretically described/modeled and observed in laboratory settings (Baines and Leitch 1989; Socolofsky and Adams 2002; 2005), the only documented in-situ subsurface plume occurred during the *Deepwater Horizon* oil spill (Bracco et al. 2020; Diercks et al. 2010), which was a catastrophic, subsea spill. As catastrophic oil spills are not reasonably foreseeable, the potential risk of a sizable subsea plume is not expected and not part of the proposed action.

Response Activities: Benthic organisms are also vulnerable to spill cleanup/response activities. During a response operation, the risk of accidental impacts from bottom-disturbing equipment is increased. Unplanned emergency anchoring or accidental losses of equipment from response vessels could occur. Response-related equipment such as seafloor-anchored booms may be used and could inadvertently contact benthic habitats and organisms. Drilling muds may be pumped into a well to stop a loss of well control. It is possible that during this process some of this mud may be forced out of the well and deposited on the seafloor near the well site. If this occurs, the impacts would be severe for any organisms buried; however, the impact beyond the immediate area would be limited. The volume of most spills is relatively low (<1,000 bbl) (refer to **Chapter 3**, Ji and Schiff 2023), and the activities required for spill clean-up or retrieval of lost equipment are expected to be minimal and localized. As infrastructure (e.g., wells, platforms) must be distanced from sensitive, hard bottom habitats, as required in BOEM lease stipulations and post-lease mitigations (**Table 4.4-2**), bottom-disturbing response activities would likely be sufficiently distanced from sensitive benthic habitat to prevent impacts.

Strikes and Collisions: It is expected that shallow-water hard bottom benthic habitats that are potentially vulnerable to accidental strikes from vessel traffic would occur only within the coastal zone and not on the OCS. The vulnerability of benthic organisms from accidental strikes and collisions on benthic communities and habitats, including protected corals, is largely the same as the effects discussed under routine OCS oil- and gas-related bottom disturbance and could include crushing, breaking, compaction, and smothering of benthic communities. Accidental effects from bottom-disturbing equipment are expected to be infrequent and highly localized.

4.4.2.3 Alternatives Analysis

Alternative A – No Action (Cancellation of a Single Proposed OCS Oil and Gas Lease Sale)

Under Alternative A, a single proposed OCS oil and gas lease sale would not occur, so there would be no new routine activities or accidental events resulting from the proposed action. Therefore, no direct or indirect impacts to benthic communities and habitats, including protected corals, would occur as a result of the proposed action (i.e., a single proposed OCS oil and gas lease sale), and the impact of Alternative A on benthic communities and habitats, including protected corals, would be **none**. However, there are ongoing OCS oil- and gas-related activities and other non-OCS oil- and gas-related activities that contribute to the baseline environment (summarized in **Chapter 4.0.1** and described in detail in Chapter 3 of the GOM Oil and Gas SID) that also affect benthic communities and habitats (including protected corals) that would still occur. Ongoing activities associated with previous OCS oil and gas lease sales (**Table 3.3-2**) could still have potential direct impacts to benthic communities and habitats (including protected corals) through discharges and wastes, bottom disturbance, offshore habitat modification/space use, unintended releases into the environment, response activities, and strikes and collisions. The potential impacts are summarized above in **Chapter 4.4.2.1 and 4.4.2.2** of this Programmatic EIS and in greater detail in Chapter 4.4.3 of the GOM Oil and Gas SID, and evaluated as part of the cumulative analysis in **Chapter 4.17.4**.

Comparison of Impacts under Alternatives B, C, and D

A proposed regionwide OCS oil and gas lease sale under Alternatives B through D, and the resulting proposed OCS oil- and gas-related development on any subsequent leases from a proposed OCS lease sale, could result in discharges and wastes, bottom disturbance, offshore habitat modification/space use, unintended releases into the environment, response activities, and strikes and collisions that could potentially impact benthic communities and habitats, including protected corals.

Alternative B represents the largest geographic area under consideration for a proposed regionwide OCS oil and gas lease sale. Alternatives C and D represent geographical constraints on available acreage for leasing, which could change the spatial distribution of the scenario activities, but not their overall activity levels. Therefore, this alternatives analysis is focused on the potential environmental impacts of a proposed regionwide OCS oil and gas lease sale (Alternative B), and then considers if these potential impacts could be reduced by the geographic constraint under each alternative considered (Alternatives C and D).

Impact determinations for each IPF that affect benthic communities and habitats (**Table 4.4-3**) and protected corals (**Table 4.4-4**) for each alternative are analyzed below. Impacts are shown both with and without the BOEM protective measures applied, if a BOEM protective measure being considered in this Programmatic EIS is applicable to that IPF. The impacts of Alternative A are not shown in **Table 4.4-3 and 4.4-4** because the impacts are **none** for all IPFs.

Table 4.4-3. Impact Determinations for Routine and Accidental Impacts to Benthic Communities and Habitats for Alternatives B-D.

Impact-Producing Factor	**BOEM's Protective Measure[1]**	**Alternative B**	**Alternative C**	**Alternative D**
Bottom Disturbance	Without Protective Measures	**Negligible** to **Major** in leased areas only	**None** in excluded areas; **Negligible** to **Major** in leased areas only	**None** in excluded areas; **Negligible** to **Major** in leased areas only
Bottom Disturbance	With Protective Measures	**Negligible** to **Minor** in leased areas only	**None** in excluded areas; **Negligible** to **Minor** in leased areas only	**None** in excluded areas; **Negligible** to **Minor** in leased areas only
Discharges and Wastes	Without Protective Measures	**Negligible** to **Major** in leased areas only	**None** in excluded areas; **Negligible** to **Major** in leased areas only	**None** in excluded areas; **Negligible** to **Major** in leased areas only
Discharges and Wastes	With Protective Measures	**Negligible** to **Minor** in leased areas only	**None** in excluded areas; **Negligible** to **Minor** in leased areas only	**None** in excluded areas; **Negligible** to **Minor** in leased areas only
Offshore Habitat Modification/Space Use	N/A	**Negligible** to **Beneficial** and/or **Negligible** to **Minor** in leased areas only	**None** in excluded areas; **Negligible to Beneficial** and/or **Negligible to Minor** in leased areas only	**None** in excluded areas; **Negligible** to **Beneficial** and/or **Negligible** to **Minor** in leased areas only
Unintended Releases into the Environment	N/A	**Negligible** to **Minor**	**Negligible** to **Minor**	**Negligible** to **Minor**
Response Activities	Without Protective Measures	**Negligible** to **Major**	**Negligible to Major**	**Negligible** to **Major**
Response Activities	With Protective Measures	**Negligible** to **Minor**	**Negligible** to **Minor**	**Negligible** to **Minor**
Strikes and Collisions	N/A	**Negligible** to **Minor**	**Negligible** to **Minor**	**Negligible** to **Minor**

Note: Alternative A is not shown in the table because the impacts from all impact-producing factors is **none**.

[1] Protective measures for application at the OCS lease sale stage are being contemplated in this Programmatic EIS. Additional BOEM protective measures for benthic communities and habitats would be considered at the site-specific stage.

Table 4.4-4. Impact Determinations for Protected Corals for Alternatives B-D.

Impact-Producing Factor	**BOEM's Protective Measure[1]**	**Alternative B**	**Alternative C**	**Alternative D**
Bottom Disturbance	Without Protective Measures	**None,** habitat not leased	**None**, habitat not leased	**None**, habitat not leased
Bottom Disturbance	With Protective Measures	**None**, habitat not leased	**None**, habitat not leased	**None**, habitat not leased
Discharges and Wastes	Without Protective Measures	**Negligible** to **Major** in leased areas only	**None**, habitat not leased	**None**, habitat not leased

Impact-Producing Factor	BOEM's Protective Measure[1]	Alternative B	Alternative C	Alternative D
Discharges and Wastes	With Protective Measures	**Negligible** to **Minor** in leased areas only	**None**, habitat not leased	**None**, habitat not leased
Offshore Habitat Modification/Space Use	N/A	**Negligible** in leased areas only	**None**, habitat not leased	**None**, habitat not leased
Unintended Releases into the Environment	N/A	**Negligible** to **Moderate**	**Negligible** to **Moderate**	**Negligible** to **Moderate**
Response Activities	Without Protective Measures	**Negligible** to **Major**	**Negligible** to **Major**	**Negligible** to **Major**
Response Activities	With Protective Measures	**Negligible**	**Negligible**	**Negligible**
Strikes and Collisions	N/A	**N/A**, resource not present in the Impact Area	**N/A**, resource not present in the Impact Area	**N/A**, resource not present in the Impact Area

Note: Alternative A is not shown in the table because the impacts from all impact-producing factors is **none**.

[1] Protective measures for application at the OCS lease sale stage are being contemplated in this Programmatic EIS. Additional BOEM protective measures for benthic communities and habitats would be considered at the site-specific stage.

Alternative B – Regionwide OCS Lease Sale

Bottom Disturbance: Alternative B considers a proposed regionwide OCS lease sale area. Within this geographic area, impacts from OCS oil- and gas-related bottom disturbance would affect benthic communities and habitats. Bottom disturbance has the potential to cause crushing, turbidity, and sedimentation to benthic communities and habitats. Based on the description of the potential impacts above and the expected amount of activity that would cause bottom disturbance to benthic communities and habitats as described in **Table 3.3-2**, impacts from bottom disturbance to benthic communities and habitats is expected to be **negligible** to **major** due to the extensive damage that could occur to sensitive benthic habitats, including structure-forming invertebrates and these communities' long recovery times. With the application of BOEM protective measures (i.e., avoidance and distancing requirements for bottom-disturbing activities), the impacts to benthic communities and habitats would be reduced to **negligible** to **minor** because bottom-disturbing activity would be sufficiently distanced from sensitive benthic habitat to prevent most impacts. Protected corals would not be affected by bottom disturbance under Alternative B as they are located within the Flower Garden Banks National Marine Sanctuary. Whole and partial blocks within the boundaries of the Flower Garden Banks National Marine Sanctuary are not available for leasing under Alternative B as of the July 2008 Memorandum on Withdrawal of Certain Areas of U.S. OCS from Leasing Disposition (East Flower Garden Bank, West Flower Garden Bank, and Stetson Bank). Impacts to protected corals from bottom disturbance would therefore be **none.**

Discharges and Wastes: Discharges and wastes can occur from any routine oil and gas activity except for helicopter operations (**Table 3.3-4**). Within this geographic area, impacts from discharges and wastes (e.g., burying and smothering) could affect benthic communities and habitats on the OCS, including protected corals, up to several thousand feet from the point of discharge (summarized in Cordes et al. 2016). Given the anticipated amount of activity described in **Table 3.3-2** for a single proposed OCS oil and gas lease sale to occur over a 40-year lifespan, discharges and wastes could result in **negligible** to **major** impacts due to the extensive damages that could occur to sensitive benthic habitats, including structure-forming invertebrates. With the application of BOEM protective measures (i.e., distancing and shunting requirements for routine discharges and wastes), the impacts to benthic communities and habitats, including protected corals, would be reduced to **negligible** to **minor** because bottom-disturbing activity would be sufficiently distanced from sensitive benthic habitat to prevent most impacts.

Offshore Habitat Modification/Space Use: Within this geographic area, impacts from offshore habitat modification/space use associated with routine oil and gas activity (**Table 3.3-4**) would affect benthic communities and habitat on the OCS. There are no BOEM-specific mitigating measures for benthic communities and habitats associated with offshore habitat modification/space use apart from distancing requirements related to mitigating bottom-disturbance impacts. Given the level of the activities described in **Table 3.3-2** for a single proposed OCS oil and gas lease sale to occur over a 40-year lifespan, impacts from offshore habitat modification/space use to benthic communities and habitats would be positive (**negligible beneficial**) because infrastructure may support habitat function and/or specific faunal species by acting as a refuge, or acting as a stepping stone between habitats, and/or negative (**negligible** to **minor**) because of the potential for infrastructure presence to allow for highly localized modification of community structure, changing hydrography, and the potential for the spread of invasive species. In addition, the impacts from offshore habitat modification/space use to protected corals would be undetectable and **negligible** because protected coral species are not associated with oil and gas platforms or artificial reefs in the GOM.

Unintended Releases into the Environment: Unintended releases into the environment could adversely affect benthic communities and habitats on the OCS, including protected corals. Non-oil spills (e.g., chemical spills and synthetic-based fluid spills) would likely be relatively infrequent based on the occurrences of these accidental spills calculated over the past decade (**Tables 3.5-2 and 3.5-3**). Based on the number and volume of accidental oil spills estimated for a single OCS lease sale (Ji and Schiff 2023), negative impacts to benthic communities and habitats, including protected corals, could range from undetectable for small spills to notable, localized impacts for larger spills. The impacts from unintended releases into the environment to benthic communities and habitats would be **negligible** to **minor**. Due to their relatively small numbers and restricted habitat, the impacts from unintended releases to the environment to protected corals would be **negligible** to **moderate**.

Response Activities: Within this geographic area, impacts from response activities would affect benthic habitat and communities on the OCS. Bottom disturbance from response activities has the potential to cause crushing, turbidity, and sedimentation to benthic communities and habitats, which is expected to be **negligible** to **major** due to the extensive damage that could occur to sensitive benthic habitats, including structure-forming invertebrates. However, the impacts from response activities to benthic communities and habitats would be **negligible** to **minor** with the adherence to distancing requirements as required in BOEM lease stipulations and post-lease mitigations, which should prevent or reduce most response impacts because the areas requiring bottom-disturbing intervention would likely already be sufficiently distanced from benthic habitats. The impacts from response activities to protected corals would similarly be **negligible** due to the even greater BOEM-distancing requirements awarded to the No Activity Zones within the Flower Garden Banks National Marine Sanctuary, where these corals are found, and the restriction of leasing of whole and partial blocks within the Sanctuary under this alternative.

Strikes and Collisions: Within this geographic area, impacts from strikes and collisions would affect benthic habitat and communities on the OCS, excluding protected corals, which are not located within the potential impact area, and therefore would have no impacts. The impacts from accidental strikes and collisions to benthic communities and habitats would be **negligible** to **minor** because accidental effects from bottom-disturbing equipment and vessel strikes are expected to be infrequent and highly localized and limited to the coastal zone**.**

Therefore, based on the description of the IPFs above and the scenario projections for a single proposed OCS oil and gas lease sale provided in **Chapter 3**, the overall unmitigated impacts from IPFs associated with Alternative B on benthic communities and habitats, including protected corals, would be **negligible** to **major** due to the extensive damage that could occur to sensitive benthic habitats, including structure-forming invertebrates. The magnitude and severity of the potential effects could vary depending on numerous factors including, but not limited to, location, frequency, and duration of the activities and resource; and the distribution, condition, and scarcity of the resource, as well as habitat type and feature-specific characteristics (e.g., seafloor relief, rugosity [i.e., surface roughness], and associated community). Major impacts could occur if rare benthic communities, such as ESA-listed corals, were crushed or smothered through direct contact with bottom-disturbing activities, resulting in population-level impacts. Without review of proposed activities as part of the mitigation process, it is not possible to predict when and where these impacts may occur. With the application of BOEM protective measures (i.e., avoidance, distancing, and shunting requirements), however, the impacts to benthic communities and habitats, including protected corals, would be reduced to **negligible** to **minor** because bottom-disturbing activity would be sufficiently distanced from sensitive benthic habitat to prevent most impacts, and soft-bottom habitat where activities would mostly occur, is not limited in the GOM.

Alternative C – Inflation Reduction Act Targeted OCS Lease Sale Area

Under Alternative C whole or partial blocks subject to the Topographic Features Stipulation and whole and partial blocks subject to the Live Bottom (Pinnacle Trend) Stipulation would be excluded from potential leasing. Excluding the whole and partial Topographic Features and Live Bottom (Pinnacle Trend) Stipulation blocks from leasing would provide even greater protection to sensitive benthic features because OCS oil- and gas-related activities would be further distanced. In addition, benthic communities and habitats located within the other areas excluded from leasing under Alternative C are not expected to experience impacts from routine OCS oil- and gas-related activities because, as discussed under Alternative B, areas of impact from routine OCS oil- and gas-related activities occur within limited areas surrounding said activity and these activities would not occur in excluded areas. Routine impacts would be limited to the areas leased under this alternative. The impacts from accidental events would be the same as described for Alternative B. However, potentially sensitive hard bottom benthic features and communities that are located outside of the whole and partial Topographic Features Stipulation, Live Bottom (Pinnacle Trend) Stipulation blocks, and all other areas excluded from leasing under Alternative C could potentially be impacted by such activities, as described in **Chapter 1.1.2.1** because they are not excluded from leasing under this alternative.

Therefore, based on the description of the IPFs above, the scenario projections for a single proposed OCS oil and gas lease sale provided in **Chapter 3**, the removal of whole and partial blocks subject to the Topographic Features and Live Bottom (Pinnacle Trend) Stipulations, as well as the other areas removed from leasing under this alternative, the overall unmitigated impacts under Alternative C would still be **negligible** to **major**. This is due to the extensive damages that could occur to sensitive benthic habitats located in blocks not removed from leasing under this alternative if distancing and other protective measures are not applied. With the application of BOEM protective measures in areas that are not removed from leasing (i.e., avoidance, distancing, and shunting requirements), the impacts to benthic communities and habitats would be reduced to **negligible** to **minor** because the required distancing mitigations would prevent most impacts to sensitive benthic habitats from bottom-disturbing activity.

Because ESA-listed corals and designated coral critical habitat considered in this analysis are found within the FGBNMS and because the corals' range and critical habitat would be removed from leasing with the exclusion of whole and partial Topographic Features Stipulation blocks under Alternative C, no OCS oil- and gas-related activities would occur within the areas where these corals are found. Therefore, based on the description of the IPFs above and the scenario projections for a single OCS oil and gas lease sale provided in **Chapter 3**, the overall impact determinations from routine IPFs (i.e., bottom disturbance, discharges and wastes, and offshore habitat modification/space use) associated with Alternative C on ESA-listed corals and designated critical habitat would be **none**. Impact determinations for accidental events (i.e., unintended releases into the environment, response activities, and strikes and collisions) would be the same as described for Alternative B.

Alternative D – Targeted OCS Lease Sale Area with Additional Exclusions

Under Alternative D, in addition to whole or partial blocks subject to the Topographic Features Stipulation and whole and partial blocks subject to the Live Bottom (Pinnacle Trend) Stipulation, whole and partial blocks around the expanded Flower Garden Banks National Marine Sanctuary (as of March 22, 2021) are excluded. Excluding whole and partial Topographic Features and Live Bottom (Pinnacle Trend) Stipulation blocks and whole and partial blocks around the expanded Flower Garden Banks National Marine Sanctuary (as of March 22, 2021) from leasing effectively provides the same protection for sensitive benthic features because all but one OCS block within the Flower Garden Banks National Marine Sanctuary is a Topographic Features Stipulation Block and not leased under either Alternative C or D. Benthic communities and habitats located within the other areas excluded from leasing under Alternative D, including all areas within the whole and partial blocks of the Gulf of Mexico Wind Leasing Call Area, are not expected to experience routine impacts from OCS oil- and gas-related activities under this alternative because activity would likely be limited to immediate areas around activity (leased areas). The impacts from accidental events would be the same as described for Alternative B. However, potentially sensitive hard bottom benthic features and communities that are located outside of the areas excluded from leasing under Alternative D could potentially be impacted by OCS oil- and gas-related activities, as described earlier, as they are not excluded from leasing under this alternative.

Therefore, based on the description of the IPFs above, the scenario projections for a single proposed OCS oil and gas lease sale provided in **Chapter 3**, and the areas removed from leasing under this alternative, the overall unmitigated impacts under Alternative D would still be **negligible** to **major**. This is due to the extensive damages that could occur to sensitive benthic habitats, including structure-forming invertebrates located in blocks not excluded from leasing under this alternative if distancing and other protective measures are not applied. With the application of BOEM protective measures in areas that are not removed from leasing (i.e., avoidance, distancing, and shunting requirements), the impacts to benthic communities and habitats would be reduced to **negligible** to **minor** because bottom-disturbing activity would be sufficiently distanced from sensitive benthic habitat to prevent most impacts.

As with Alternative C, ESA-listed corals and designated coral critical habitat considered in this analysis would not experience any impacts from routine IPFs under Alternative D because whole and partial Topographic Features Stipulation blocks and whole and partial blocks around the expanded Flower Garden Banks National Marine Sanctuary (as of March 22, 2021) are excluded from leasing under Alternative D. Impact determinations for accidental events (unintended releases into the environment, response activities, and strikes and collisions) would be the same as described for Alternative B.

4.4.3 Incomplete or Unavailable Information

BOEM has identified incomplete or unavailable information that may be relevant to reasonably foreseeable impacts on benthic communities and habitats, including the locations of benthic communities and habitats in the GOM, the toxicity of oil and dispersants to benthic organisms, the long-term effects of OCS oil- and gas-related infrastructure, the long-term effects associated with climate change-related factors, and the ecological effects and interactions between benthic communities and fish communities. BOEM has determined that such information is not essential to a reasoned choice among alternatives because a complete understanding of these communities and all environmental parameters affecting them is not necessary for a reasoned choice among alternatives. BOEM has used the best available scientific information to date and reasonably accepted scientific methodologies to extrapolate from existing information. Therefore, the incomplete or unavailable information, while relevant, would not likely change the impact conclusions reached in this analysis and is not essential to a reasoned choice among alternatives.

BOEM recognizes that there is incomplete or unavailable information related to topographic features and associated communities, including protected corals, in general and specifically in relation to routine activities, accidental events, and cumulative impacts. However, the available information is adequate to make a determination with respect to reasonably foreseeable IPFs associated with a proposed action. Since the 1970s, BOEM and its predecessor agencies have supported long-term monitoring of the East and West Flower Garden Banks within the Flower Garden Banks National Marine Sanctuary for any impacts related to OCS oil- and gas-related activities. At the East and West Flower Garden Banks, corals have generally flourished (Johnston et al. 2022, and references therein) even as OCS oil- and gas-related development has occurred. BOEM used existing information and reasonably accepted scientific methodologies to extrapolate from available information, including the information collected from the long-term monitoring of the East and West Flower Garden Banks within the Flower Garden Banks National Marine Sanctuary in completing this analysis and formulating the conclusions presented here. BOEM has determined that the currently available body of evidence supports the preceding analyses. Therefore, BOEM has determined that the incomplete or unavailable information is not essential to a reasoned choice among alternatives.

4.5 PELAGIC COMMUNITIES AND HABITATS

The pelagic zone (i.e., habitat) encompasses the entire water column from the sea surface down to the seafloor. Refer to Chapter 4.3.3.1 of the GOM Oil and Gas SID for a detailed description of the pelagic zone within the GOM. The analysis in this chapter focuses on planktonic (i.e., phytoplankton, zooplankton, ichthyoplankton) and *Sargassum* (*S. natans* and *S. fluitans*) communities. For the purposes of this chapter, plankton refers to phytoplankton, zooplankton, and ichthyoplankton combined unless otherwise specified. Information on the larger biota that inhabit or utilize pelagic habitats is provided in **Chapters 4.6-4.9**. Further, information concerning coastal communities and habitats and benthic communities and habitats, including protected corals, is provided in **Chapters 4.3 and 4.4**, respectively. Lastly, a description of how climate change is influencing the pelagic zone is provided in Chapter 3.4 of the GOM Oil and Gas SID.

4.5.1 Affected Environment

A brief overview of pelagic communities and habitats is provided below; refer to Chapter 4.3.3.1 of the GOM Oil and Gas SID for more details. Plankton are plants (phytoplankton) and animals (zooplankton) that drift with the currents (i.e., unable to swim against a current) throughout all depths of the GOM and form the base of the pelagic food chain. Plankton can either be planktonic for their entire life cycle (i.e., holoplankton) or only temporarily during the early stages of their life. An essential component of temporary zooplankton is ichthyoplankton (i.e., fish eggs, larvae, and small juveniles) (Rowe 2017). They are predators of the lower tropic planktonic organisms (e.g., dinoflagellates and copepods) and important prey for larger marine organisms (BOEM 2021b). Ichthyoplankton are predominantly located within the upper water column, with their distribution influenced by fish spawning locations and oceanographic processes (e.g., currents and temperature) (Rowe 2017).

A unique floating habitat ubiquitous in the epipelagic zone of the GOM OCS is *Sargassum*. *Sargassum* are pelagic species of free-floating, brown macroalgae that generally occur as large mats, or "floating islands." These mats can be up to dozens of meters long as well as in diameter. *Sargassum* mats are not rigidly attached structures; thus, they can be broken up naturally by wave action as well as washed ashore (i.e., beached). *Sargassum* provides a dynamic structural habitat in the surface waters of the GOM where there is a lack of natural structural habitat due to the depths and distance from shore. This habitat provides for life functions of numerous species and can act as a vehicle for dispersal of some of its inhabitants, providing them with substratum, predator protection, and concentration of food within the pelagic zone (Gulf of Mexico Fishery Management Council 2004). For example, *Sargassum* is vital to several fish species as both nursery habitat and adult feeding grounds and is considered EFH in the GOM and South Atlantic (South Atlantic Fishery Management Council 2002). In addition, *Sargassum* habitat has been identified as potential foraging grounds for some marine mammals, particularly in frontal zones (Laffoley et al. 2011; Witherington et al. 2012), and is also designated as critical habitat by NMFS for the loggerhead (79 FR 39856) and proposed critical habitat for green sea turtles (88 FR 46572). Pelagic seabirds (e.g., masked boobies, bridled terns, and black terns) also utilize *Sargassum* mats as foraging grounds and roosting sites (Haney 1986; Moser and Lee 2012).

4.5.2 Environmental Consequences

Pelagic communities and habitats in the GOM are affected by existing environmental conditions, natural processes and phenomena, and human-induced factors. Chapter 4.3.3.1 of the GOM Oil and Gas SID describes the programmatic concerns influencing pelagic communities and habitats, including climate change and ocean acidification. There are also several OCS oil- and gas-related activities and non-OCS oil- and gas-related activities that have the potential to impact pelagic communities and habitats (**Table 4.5-1**). BOEM conducted an initial screening of IPFs in the GOM Oil and Gas SID and determined that air emissions and pollution, discharges and wastes, bottom disturbance, noise, lighting and visual impacts, offshore habitat modification/space use, unintended releases into the environment, response activities, and strikes and collisions could potentially impact pelagic communities and habitats. These IPFs and their potential to affect pelagic communities and habitats are discussed below and in greater detail in Chapters 4.3.3.2 of the GOM Oil and Gas SID. Supporting rationale for IPFs that were not analyzed in detail in this Programmatic EIS can also be found in Chapters 4.3.3.2.1 and 4.3.3.2.2 of the GOM Oil and Gas SID. New information released since the development of the GOM Oil and Gas SID and relevant to the analysis is included in the applicable chapters below.

Table 4.5-1. Impact-Producing Factors with the Potential to Impact Pelagic Communities and Habitats.

OCS Oil- and Gas-Related Routine Activities	OCS Oil- and Gas-Related Accidental Events	Non-OCS Oil- and Gas-Related Activities
Air Emissions and Pollution	Unintended Releases into the Environment	Air Emissions and Pollution
Discharges and Wastes	Response Activities	Discharges and Wastes
Bottom Disturbance	Strikes and Collisions	Bottom Disturbance
Noise	-	Noise
Lighting and Visual Impacts	-	Lighting and Visual Impacts
Offshore Habitat Modification/ Space Use	-	Offshore Habitat Modification/ Space Use
-	-	Strikes and Collisions
-	-	Climate Change

There are several existing regulatory programs and protective measures enforced by BOEM, BSEE, and other agencies that reduce or minimize the environmental effects of these IPFs to pelagic communities and habitats in the GOM. The regulatory requirements listed in **Table 4.5-2** all reduce impacts to pelagic communities and habitats by regulating discharges and wastes and air emissions and pollution. Lessees are required to perform OCS oil- and gas-related activities in accordance with regulatory requirements. Therefore, this analysis factors in the mitigating effects of all applicable regulatory requirements as part of the proposed action when making impact determinations.

Table 4.5-2. Existing Regulatory Requirements and Protective Measures That Reduce the Potential Impacts of Impact-Producing Factors.

Regulatory Requirement or Protective Measure[1]	Enforcing Agency	Impact-Producing Factor(s) Reduced/Avoided	Supporting References and Sections
Post-lease Water Quality Review	BOEM, BSEE	Discharges and Wastes	Chapter 5.1.1 of the GOM Oil and Gas SID, **Chapters 3.4.2 and 4.2** of this Programmatic EIS
Air quality reviews of all site-specific plans for compliance with NAAQS through OCSLA[2]	BOEM, BSEE	Air Emissions and Pollution	Chapters 5.6 and 6 of the GOM Oil and Gas SID, 30 CFR part 550, 30 CFR part 250, **Chapter 4.1** of this Programmatic EIS
Air quality permits for compliance with Section 328 of the Clean Air Act[3]	USEPA	Air Emissions and Pollution	40 CFR part 55, Chapters 2.1 and 6 of the GOM Oil and Gas SID
BSEE Pollution Prevention (30 CFR § 250.300)	BSEE	Discharges and Wastes	Chapter 5.1.3 of the GOM Oil and Gas SID
MARPOL Annex V Treaty	USCG	Discharges and Wastes	Chapter 2.9.1.7 of the GOM Oil and Gas SID
International Convention for the Prevention of Pollution from Ships (MARPOL) Annex VI and the Act to Prevent Pollution from Ships (APPS)	USEPA, USCG	Air Emissions and Pollution	33 U.S.C §§ 1901-1915 – Prevention of Pollution from Ships
Federal Water Pollution Control Act of 1948, amended in 1972 as the Clean Water Act (CWA)	USEPA	Discharges and Wastes, Bottom Disturbance	Chapters 2.2, 4.2.2, and 5.11 of the GOM Oil and Gas SID
CWA Section 402, the National Pollutant Discharge Elimination System (NPDES) for Regions 4 and 6	USEPA	Discharges and Wastes	**Chapter 3.4.2** of this Programmatic EIS and Chapters 2.2 and 5.11 of the GOM Oil and Gas SID
CWA Section 312, Vessel Sewage Discharges	USEPA	Discharges and Wastes	Chapters 4.2.2.2 and 5.11 of the GOM Oil and Gas SID

Regulatory Requirement or Protective Measure[1]	Enforcing Agency	Impact-Producing Factor(s) Reduced/Avoided	Supporting References and Sections
Vessel Incidental Discharge Act (VIDA) Framework for Incidental Discharges under CWA Section 312(p)	USEPA, USCG	Discharges and Wastes	Chapter 4.2.2.2 of the GOM Oil and Gas SID
BSEE Decommissioning Requirements (30 CFR subpart Q)	BSEE	Discharges and Wastes, Bottom Disturbance	Chapter 4.2.2.2 of the GOM Oil and Gas SID

[1] Refer to Chapter 6 of the GOM Oil and Gas SID for conditions of approval commonly applied at the post-lease stage.
[2] Only for activities in the Central and Western Planning Areas (west of longitude 87.5 degrees).
[3] Only for activities in the Eastern Planning Area (east of longitude 87.5 degrees).

4.5.2.1 OCS Oil- and Gas-Related Impact-Producing Factors from Routine Activities

Air Emissions and Pollution: Air emissions and pollution from OCS oil- and gas-related routine activities mostly occur above the sea surface but could indirectly affect pelagic waters through the absorption of CO_2 contributing to ocean acidification (refer to **Chapter 1.2.4**). There are several existing regulatory programs and requirements in place to reduce or minimize air emissions and pollution (**Table 4.5-2**). For example, BOEM's regulations require air quality reviews for all post-lease plans (refer to Chapter 5.6 of the GOM Oil and Gas SID and **Chapter 4.1** of this Programmatic EIS) and, if required based on site-specific environmental reviews, BOEM assigns conditions of approval that are enforced by BSEE. Since lessees are required to perform OCS oil- and gas-related activities in accordance with regulatory requirements, emissions and pollution from the activities are localized and are expected to dissipate (i.e., return to baseline conditions) quickly.

Discharges and Wastes: Pelagic habitats and communities, including *Sargassum*, are exposed to operational discharges and wastes from OCS oil- and gas-related routine activities (e.g., mud cuttings, graywater, and sanitary wastes). Effects can include localized and temporary biodiversity loss, community structure shifts (i.e., changes in species diversity, species richness) that could affect predator-prey interactions, habitat degradation and suitability changes, and suspended material in the water column that could potentially increase nutrient availability and result in a localized increase in phytoplankton abundance (Fernandes et al. 2023), reduce the amount of light available for photosynthesis (Grobbelaar 2009), and/or clog and damage appendages and feeding structures (Berry et al. 2003). Lessees are required to perform OCS oil- and gas-related activities in accordance with regulatory requirements that minimize or avoid impacts to water quality and pelagic habitat from discharges (e.g., ballast), trash, and other waste (e.g., NPDES, 30 CFR § 250.300, and MARPOL 73/78; refer to **Table 4.5-2**). A description of these rules and regulations is provided in **Chapter 3.4.4**.

The discharge of routine operational waste streams is regulated by the USEPA Regions 4 and 6 in the Gulf of Mexico. The CWA Section 402, 33 U.S.C. § 1342, authorizes the USEPA to issue National Pollutant Discharge Elimination System (NPDES) permits allowing discharges on the condition they will meet certain requirements, including CWA Sections 301, 304, 306, 401, and 403.

Discharges are only allowed if the requirements of the CWA and the corresponding NPDES permit are met, including no unreasonable degradation of the environment as discussed in Section 403 of the CWA (BOEM 2020a; USEPA 2023b). BOEM conducts post-lease water quality reviews for routine OCS oil- and gas-related activities to ensure that the above USEPA regulatory requirements, as shown in **Table 4.5-2**, are met prior to plan approval. Refer to **Chapter 4.2** for more detail. Discharges and wastes resulting from these routine activities are regulated, localized, and expected to dissipate quickly. The dispersion and dilution of the discharges is influenced by a variety of factors, including the discharge composition, discharge rate, discharge point (e.g., depth and direction), and oceanographic conditions (e.g., currents, winds, waves temperature, and salinity) (Beyer et al. 2020). Based on available data, demonstrated effects have been shown to be relatively localized within 1,000 m (3,281 ft) of the discharge for drilling fluids and cuttings and within several hundred meters for produced waters (USEPA 2022a).

Bottom Disturbance: Pelagic communities and habitats are exposed to bottom disturbance from OCS oil- and gas-related routine marine construction and seafloor activity. Pelagic organisms' (e.g., larval fish and zooplankton) feeding is potentially affected by increased turbidity from bottom disturbances by the clogging and damaging of appendages and feeding structures (Berry et al. 2003). Suspended particles can also reduce light penetration, which may impede photosynthesis resulting in reduced phytoplankton biomass. However, if effects were to occur, they would be expected to occur in shallower, coastal waters where resuspension from bottom-disturbing activities could extend up into the photic zone of areas already experiencing high sediment loads from the Mississippi/Atchafalaya River System (Meade and Moody 2010; Yedema et al. 2023). Bottom disturbances resulting from routine activities are localized and temporary and any associated elevated turbidity levels are expected to dissipate quickly.

Noise: Active acoustic sources (e.g., seismic surveys), vessels, and equipment used in OCS oil- and gas-related routine activities generate underwater noise. These noise sources can affect the soundscape of pelagic habitats leading to both indirect (e.g., area avoidance) and direct (e.g., body malformations) effects to planktonic organisms. High-intensity noises (e.g., airguns, pile driving, and decommissioning explosives) could lead to the injury and mortality of organisms. However, study results have been indeterminate concerning the potential effects on plankton, including larvae from high-intensity underwater sounds (refer to **Chapter 4.5.3**). Generally, limited spatial and temporal impacts have been found from equipment such as seismic air guns (Richardson et al. 2017) and pile driving (Popper et al. 2014a). For example, Popper et al. (2014a) summarized that ichthyoplankton mortality could be expected in very close proximity (<5 m; 16 ft) to airgun exposure with the mortality rate considered insignificant compared to natural mortality.

Lighting and Visual Impacts: Artificial lighting as a result of OCS oil- and gas-related routine activities (e.g., platforms and vessels) can result in the attraction of organisms and/or alter normal diel migration patterns. Potential effects are expected to vary by location (e.g., number of sources) and light source (e.g., type and irradiance). Study results suggest that artificial lighting could result in an increase in local (i.e., within the illuminated area) phytoplankton abundance, with the level of effect differing depending on wavelength (e.g., blue, red, and white). The local abundance of zooplankton could also change as result of attraction or disruption of normal diel vertical migration patterns (Diamantopoulou et al. 2021; Marangoni et al. 2022). Thus, artificial lighting (e.g., platforms) may provide enhanced (beneficial) opportunities for foraging predators by providing sufficient light to locate and capture zooplankton and ichthyoplankton prey, as well as by concentrating positively phototaxic prey taxa (Keenan et al. 2007). The lower trophic levels possibly experience the adverse effect of localized areas of higher mortality due to elevated predation levels.

Offshore Habitat Modification/Space Use: The OCS oil- and gas-related routine activities include placement of vertical structures (e.g., platforms and subsea trees) on the OCS. This offshore habitat modification/space use creates habitat that would otherwise not exist within the water column. The presence of artificial structures can result in the attraction of organisms and alter normal migration patterns (e.g., deviation from their original direction and delaying or preventing arrival) and predator/prey interactions (e.g., concentrating prey making them more vulnerable). Effects would be species- and life stage-specific and depend on the number, type, and spacing of structures that are placed on the OCS.

4.5.2.2 OCS Oil- and Gas-Related Impact-Producing Factors from Accidental Events

Unintended Releases into the Environment: Unintended releases into the environment could affect pelagic habitat quality and function and associated communities, including *Sargassum*. Polycyclic aromatic hydrocarbons (PAHs) in spilled oil can have toxic effects to plankton, and sea-surface slicks could inhibit light penetration essential to phytoplankton for photosynthesis, resulting in reduced phytoplankton growth and numbers. Alternatively, phytoplankton abundance could increase in response to the addition of nutrients or zooplankton could ingest spilled oil, reducing the abundance of phytoplankton grazers, causing increases in phytoplankton. An increase in phytoplankton could result in a bloom and possible oxygen depletion and/or toxin production (Quigg et al. 2021). Zooplankton have been found to be sensitive to oil exposure, for example causing acute toxicity in copepods or with sublethal exposures causing decreased copepod feeding, egestion, and reproduction or altering behavior (e.g., swimming). Larval stages of marine invertebrates have also generally been found to be sensitive to oil exposure (Buskey et al. 2016). Typically, early life stages of fish are also more sensitive to acute oil exposure than adults, but some research indicates that embryos, depending on their developmental stage, would be less sensitive to acute exposure than larval stages (Fucik et al. 1995). Sea-surface slicks are subject to the same oceanographic processes that influence *Sargassum* and plankton movement and can result in them rafting together. The intensity of these effects would be species-specific, depend on the life stage exposed, and depend on the concentration and duration of exposure. Further, the effects would depend on the volume of any spill and time before it is actively removed as part of a spill response or naturally weathers (refer to **Chapter 3.5.1.1**). Further, plankton have a naturally high mortality rate and *Sargassum* has a yearly cycle that promotes quick recovery from impacts.

Although vessel and platform operators are required to take preventative measures against the loss of marine trash and debris, accidental releases may still occur. Floating debris is also subject to the same oceanographic processes that influence *Sargassum* and plankton movement and can result in them rafting together. Debris such as plastics can degrade and become microdebris (e.g., microplastics, <5 millimeters in size), which can be ingested by the pelagic community. Negative effects of microdebris ingestion include physical damage (e.g., internal abrasions and gastrointestinal blockages) and exposure to organic pollutants, toxins, or foreign microbes that adhere to the debris surface and can lead to decreased growth, reproduction, and survival. Effects would be species-specific and life stage-dependent, with a possible trend found for decreasing exposure to microdebris with distance from shore in the GOM (Lestrade and Hernandez 2023). Industrialized bays appear to have higher microplastics levels than the open ocean, likely due to the proximity of microplastic sources (e.g., plastic manufacturing facilities) (Grace et al. 2022).

Response Activities: Response activities could cause injury/mortality of plankton in the area (e.g., burning and chemical dispersants). Further, response activities could also remove and/or concentrate plankton and *Sargassum* into affected areas (e.g., booms). Unlikely to be used on smaller spills, dispersants, when used during an oil-spill response, could be more toxic than oil alone, which is attributed to the chemical properties of the dispersants and greater accessibility of oil droplets. The effects of dispersants are species-specific, which can lead to community changes (Quigg et al. 2021). For example, Laramore et al. (2016) found that larval pink shrimp exposed to oil alone and oil treated with dispersants experienced greater negative impacts to the dispersant; impacts differed between larval stages, with zoea being the most sensitive. Similarly, Eastern oysters exposed to dispersants experienced some negative effects to immunological and physiological functions (Jasperse et al. 2018). In contrast, the effects of chemical dispersants on the larvae of blue crabs were laboratory tested, and only the larvae exposed to the highest treatment levels experienced significant increases in mortality (Anderson Lively and McKenzie 2014). The activities required for spill cleanup or retrieval of lost equipment are expected to be localized and minimized with monitoring for early detection of leaks, including leak detection systems that can enhance the ability to detect spills, which can result in reduced response times.

Strikes and Collisions: Vessel traffic from OCS oil- and gas-related routine activities can affect pelagic communities, including *Sargassum*, through strikes or ship wake effects (e.g., turbulence). Although potentially causing fragmentation, vessel strikes do not eliminate *Sargassum* habitat, which is prolific in the GOM and reproduces by fragmentation. Because of their limited swimming ability, vessel strikes could cause injury/mortality of plankton. Vessel traffic can also affect pelagic communities through the uptake and discharge of cooling and ballast water. These water uses cause impingement/entrainment, resulting in injury/mortality of plankton and *Sargassum*. However, plankton have a naturally high mortality rate, and *Sargassum* has a yearly cycle that would promote quick recovery from vessel traffic-related impacts.

4.5.2.3 Alternatives Analysis

Alternative A – No Action (Cancellation of a Single Proposed OCS Oil and Gas Lease Sale)

Under Alternative A, a proposed OCS oil and gas lease sale would not occur, so there would be no new routine activities or accidental events resulting from the proposed action. Therefore, the direct or indirect impacts to pelagic communities and habitats that would occur as a result of the proposed action (i.e., a single proposed OCS oil and gas lease sale) are **none**. However, ongoing OCS oil- and gas-related activities and other non-OCS oil- and gas-related activities that contribute to the baseline environment (summarized in **Chapter 4.0.1** and described in detail in Chapter 3 of the GOM Oil and Gas SID) that also affect pelagic communities and habitats that would still occur. Ongoing activities associated with previous OCS oil and gas lease sales (**Table 3.3-2**) could still have potential direct impacts to pelagic communities and habitats through air emissions and pollution, discharges and wastes, bottom disturbance, light and visual impacts, noise, offshore habitat modification/space use, unintended releases into the environment, response activities, and strikes and collisions. The potential impacts are summarized above in **Chapter 4.5.2.2** and in greater detail in Chapter 4.4.3 of the GOM Oil and Gas SID and evaluated as part of the cumulative analysis in **Chapter 4.17.5** of this Programmatic EIS.

Comparison of Impacts under Alternatives B, C, and D

A proposed regionwide OCS oil and gas lease sale under Alternatives B through D, and the resulting OCS oil- and gas-related development on any subsequent leases from the proposed OCS lease sale, would result in air emissions and pollution, discharges and wastes, bottom disturbance, noise, lighting and visual impacts, offshore habitat modification/space use, unintended releases into the environment, response activities, and strikes and collisions that could potentially impact pelagic communities and habitats.

Alternative B represents the largest geographic area under consideration for a proposed regionwide OCS oil and gas lease sale. Alternatives C and D represent geographical constraints on available acreage for leasing, which could change the spatial distribution of the scenario activities, but not their overall activity levels. Therefore, this alternatives analysis is focused on the potential environmental impacts of a proposed regionwide OCS oil and gas lease sale (Alternative B) and then considers if these potential impacts could be reduced by the geographic constraint under each alternative considered (Alternatives C and D).

Table 4.5-3 shows the impact determinations for each IPF that affects pelagic communities and habitats for each alternative analyzed. The impacts of Alternative A are not shown in **Table 4.5-3** because the impacts are **none** for all IPFs.

Table 4.5-3. Impact Determinations for Routine and Accidental Impacts to Pelagic Communities and Habitats for Alternatives B-D.

Impact-Producing Factor	BOEM's Protective Measure[1]	Alternative B	Alternative C	Alternative D
Air Emissions and Pollution	N/A	**Negligible**	**None** in excluded areas; **Negligible** in leased areas only	**None** in excluded areas; **Negligible** in leased areas only

Impact-Producing Factor	BOEM's Protective Measure[1]	Alternative B	Alternative C	Alternative D
Discharges and Wastes	N/A	**Negligible** to **Minor**	**None** in excluded areas; **Negligible** to **Minor** in leased areas only	**None** in excluded areas; **Negligible** to **Minor** in leased areas only
Bottom Disturbance	N/A	**Negligible**	**None** in excluded areas; **Negligible** in leased areas only	**None** in excluded areas; **Negligible** in leased areas only
Noise	N/A	**Negligible** to **Minor**	**None** in excluded areas; **Negligible** to **Minor** in leased areas only	**None** in excluded areas; **Negligible** to **Minor** in leased areas only
Lighting and Visual Impacts	N/A	**Negligible**	**None** in excluded areas; **Negligible** in leased areas only	**None** in excluded areas; **Negligible** in leased areas only
Offshore Habitat Modification/ Space Use	N/A	**Negligible** to **Minor**	**None** in excluded areas; **Negligible** to **Minor** in leased areas only	**None** in excluded areas; **Negligible** to **Minor** in leased areas only
Unintended Releases into the Environment	N/A	**Negligible** to **Minor**	**Negligible** to **Minor**	**Negligible** to **Minor**
Response Activities	N/A	**Negligible** to **Minor**	**Negligible** to **Minor**	**Negligible** to **Minor**
Strikes and Collisions	N/A	**Negligible**	**Negligible**	**Negligible**

Note: Alternative A is not shown in the table because the impacts from all impact-producing factors is **none**.

[1] No programmatic protective measures for application at the OCS lease sale stage are being contemplated in this Programmatic EIS. All BOEM protective measures for pelagic communities and habitats would be considered at the site-specific stage.

Alternative B – Regionwide OCS Lease Sale

Air Emissions and Pollution: Alternative B considers a proposed regionwide OCS lease sale area. Within this geographic area, air emissions and pollution could indirectly affect pelagic communities and habitats, including *Sargassum*, through the absorption of CO_2 in the upper water column. Given the level of routine oil and gas activities that could lead to air emissions and pollution (e.g., G&G surveys, structure installation, pipeline installation, structure removal, vessel trips, and helicopter operations) described in **Table 3.3-2** for a single proposed OCS oil and gas lease sale, any impacts are expected to be **negligible** given the basin-wide distribution of *Sargassum* and plankton in the northern GOM, which would allow for rapid recovery of any affected areas through natural mixing (i.e., currents, wind, and tides). Any effects are expected to vary by location (e.g., the species present and number of emission sources), dissipate (i.e., return to baseline) quickly, and are not anticipated to reach a level that has population-level effects to pelagic communities or detectable effects on pelagic habitat function or use.

Discharges and Wastes: Within this geographic area, discharges and wastes could affect pelagic communities and habitats, including *Sargassum*, located within discharge plumes. Given the level of routine oil and gas activities that could lead to discharges and waste (e.g., exploration, development, and production wells; and vessel trips) described in **Table 3.3-2** for a single proposed OCS oil and gas lease sale, any resulting impacts are expected to be **negligible** to **minor** with discharges and wastes anticipated to be highly localized and dissipate (i.e., return to baseline conditions) quickly. Oceanographic drivers would cause plankton and *Sargassum* to passively float in and out of affected waters (i.e., short-term, temporary exposure); however, the basin-wide distribution and abundance of plankton and *Sargassum* in the northern GOM would allow for rapid recovery of any affected areas through natural mixing (i.e., currents, wind, and tides) once the plume dissipates. Impacts are not expected to reach a level that would have population-level effects to pelagic communities or be detectable when compared to natural variation and mortality rates. Further, these temporary, localized effects are not expected to lead to any substantial, long-term changes to pelagic habitat function or use.

Bottom Disturbance: Within this geographic area, bottom disturbance could affect pelagic communities and habitats through an increase in water column turbidity. Given the level of routine oil and gas activities described in **Table 3.3-2** for a single proposed OCS oil and gas lease sale that could lead to bottom disturbance (e.g., structure installation; pipeline installation; structure removal; and exploration, development, and production wells), any impacts are expected to be **negligible**. Effects would only be expected to occur in shallow, coastal waters where resuspension from bottom-disturbing activities could reach the photic zone where plankton and *Sargassum* reside. In all cases, any effects from elevated turbidity levels are anticipated to be temporary with baseline conditions returning within a short period of time, leaving no measurable or detectable impacts (i.e., short-term, temporary exposure). Oceanographic drivers would cause plankton and *Sargassum* to passively float in and out of affected waters; however, the basin-wide distribution and abundance of plankton and *Sargassum* in the northern GOM would allow for rapid recovery of any affected areas through natural mixing (i.e., currents, wind, and tides) once the turbidity plume dissipates. Impacts are not expected to reach a level that would have population-level effects to pelagic communities or be detectable when compared to natural variation and mortality rates. Further, these temporary, localized effects are not expected to lead to any substantial, long-term changes to pelagic habitat function or use.

Noise: Within this geographic area, noise could affect pelagic communities and habitats, including *Sargassum* associated fauna, within the ensonified area. Underwater noise generated from activities associated with a proposed regionwide OCS lease sale (e.g., vessel engines and seismic airgun surveys) has the potential to cause both indirect (e.g., behavioral effects such as area avoidance) and direct (e.g., mortality or body malformations) effects. Effects would be species- and life stage-specific and depend on exposure levels and duration. Given the level of routine oil and gas activities described in **Table 3.3-2** for a single proposed OCS oil and gas lease sale that could lead to elevated noise levels (e.g., G&G surveys, structure installation, pipeline installation, structure removal with explosives, vessel trips, and helicopter operations), potential impacts are expected to be **negligible** to **minor** with underwater noise (e.g., seismic airgun surveys) potentially resulting in the injury or mortality of planktonic organisms within the immediate proximity (meters). Oceanographic drivers would cause plankton and *Sargassum* to passively float in and out of ensonified waters; however, the basin-wide distribution and abundance of plankton and *Sargassum* in the northern GOM would allow for rapid recovery of any affected areas through natural mixing (i.e., currents, wind, tides) once sound levels return to normal. Impacts are not expected to reach a level that would have population-level effects to pelagic communities or be detectable when compared to natural variation and mortality rates. **Minor** adverse impacts could also occur to the quality of pelagic and *Sargassum* habitat in the localized area of exposure (e.g., species avoidance); however, the quality of the habitat would be expected to immediately return to baseline conditions once the activity creating the sound (e.g., pile driving) has stopped. These temporary, localized effects are not expected to lead to any significant, long-term changes to pelagic habitat function or use.

Lighting and Visual Impacts: Within this geographic area, lighting and visual impacts could affect pelagic habitats and communities at or near the sea surface. Artificial lighting may result in the attraction of organisms and/or alter normal diel migration patterns with potential effects varying by location (e.g., the species and life stages present, amount of artificial light produced, and wavelength). Given the level of routine OCS oil- and gas-related activities described in **Table 3.3-2** for a single proposed OCS oil and gas lease sale that could lead to artificial lighting (e.g., platforms and vessels), any impacts are expected to be **negligible** and highly localized. The basin-wide distribution and abundance of plankton and *Sargassum* in the northern GOM would allow for rapid recovery of any affected areas through natural mixing (i.e., currents, wind, and tides) during daylight hours. Impacts are not expected to reach a level that would have population-level effects to pelagic communities or be detectable when compared to natural variation. The areas that would be affected by the installation of lighted structures or passing of lighted vessels do not contain unique pelagic habitats or communities that would be expected to differ from the remaining areas. In addition, the projected number of installed production structures is less than the number that is projected to be removed (**Table 3.3-2**), resulting in a presumed net reduction in the overall amount of artificial lighting contributed by OCS oil- and gas-related activities. Thus, localized and spatially dispersed effects from artificial lighting are not expected to lead to any substantial, long-term changes to pelagic habitat function or use in the GOM.

Offshore Habitat Modification/Space Use: Within this geographic area, offshore habitat modification/space use could affect pelagic communities, including *Sargassum*, within proximity to the emplaced structures on the OCS (e.g., platforms). The offshore habitat modification/space use has the potential to create habitat that would otherwise not exist within the water column and alter normal migration patterns and predator/prey interactions. Based on the level of routine OCS oil- and gas-related activities described in **Table 3.3-2** for a single proposed OCS oil and gas lease sale (e.g., platforms), any impacts are expected to be **negligible** to **minor** and localized around the structures. The basin-wide distribution and abundance of plankton and *Sargassum* within the northern GOM would allow for rapid recovery of any affected areas through natural mixing (i.e., currents, wind, and tides). Thus, impacts are not expected to reach a level that would have population-level effects to pelagic communities or be detectable when compared to natural variation. Further, the areas that would be affected by the installation of structures do not contain unique pelagic habitats or communities that would be expected to differ from the remaining areas. In addition, the projected number of installed production structures is less than the number that is projected to be removed (**Table 3.3-2**). Therefore, the localized effects from the placement of artificial structures are not expected to lead to any significant, long-term changes to pelagic habitat function or use in the GOM.

Unintended Releases into the Environment: Within this geographic area, **u**nintended releases into the environment could affect pelagic communities, including *Sargassum*, located within the release plume as well as habitat quality and function. Impacts from unintended releases into the environment would be temporary and/or localized to the habitat and species common to the area. Oceanographic drivers would cause plankton and *Sargassum* to passively float in and out of affected waters; however, the basin-wide distribution and abundance of plankton and *Sargassum* in the northern GOM would allow for rapid recovery of any affected areas through natural mixing (i.e., currents, wind, and tides) once baseline conditions return following oil recovery and/or weathering. Further, plankton have a naturally high mortality rate and *Sargassum* has a yearly cycle that promotes quick recovery; therefore, impacts to pelagic communities and habitats from unintended releases are anticipated to be **negligible** to **minor**. The effects from an unintentional release would be life stage- and species-specific and challenging to separate from background mortality and variability and are not expected to result in population-level effects to GOM pelagic communities or significant effects on GOM pelagic habitat function or use.

Response Activities: Within this geographic area, response activities could affect pelagic communities and habitats, including *Sargassum*, located within the area of cleanup. Response activities could cause injury/mortality of plankton in the area (e.g., burning and chemical dispersants) and remove *Sargassum* and associated organisms (e.g., booms). Any impacts from response activities to pelagic communities and habitats would be **negligible** because the activities required for spill cleanup or retrieval of lost equipment are expected to be minimized with early detection of a release and localized. If dispersants were to be used during an oil-spill response to a larger spill, impacts to pelagic communities and habitats from unintended releases are anticipated to be life stage- and species-specific and **negligible** to **minor**. It is unlikely any measurable changes in habitat quality would occur because of the basin-wide distribution and high abundance of plankton and *Sargassum* and natural mixing (i.e., currents, wind, and tides) in the northern GOM. No resulting detectible impacts to pelagic communities and habitats are expected compared to natural variation (i.e., challenging to separate from background mortality and variability).

Strikes and Collisions: Within this geographic area, impacts from strikes and collisions could affect pelagic communities and habitats, including *Sargassum*, located within the vessel's path. Vessel strikes can cause fragmentation of *Sargassum* and injury/mortality to plankton. Any impacts from accidental strikes and collisions to pelagic communities and habitats would be intermittent, localized, and expected to be **negligible** given the basin-wide distribution of *Sargassum* and plankton, which would allow for rapid recovery of any affected areas through natural mixing (i.e., currents, wind, and tides) and the naturally high mortality rate of plankton. Effects are not expected to reach a level that would have population-level effects to pelagic communities or substantial effects on pelagic habitat function or use.

Therefore, based on the description of the IPFs above and the scenario projections for a single proposed OCS oil and gas lease sale provided in **Chapter 3** (**Table 3.3-2**), the overall impacts from IPFs associated with Alternative B on pelagic communities and habitats would be **negligible** to **minor**. This is because of the localized nature of the effects compared to the basin-wide distribution of plankton and *Sargassum* in the northern GOM, which would allow for rapid recovery of any affected areas through natural mixing (i.e., currents, wind, and tides). The effects from air emissions, discharges, bottom disturbance (e.g., turbidity), noise, vessel lighting, and accidental events are expected to return to baseline conditions within a short period of time, leaving no long-term measurable effects. In addition, lessees are required to perform OCS oil- and gas-related activities in accordance with regulatory requirements (refer to **Table 4.5-2**), including post-lease water quality and air quality reviews that ensure compliance. Impacts are not anticipated to reach a level that would have population-level effects to pelagic communities or be detectable when compared to natural variation and mortality (i.e., stage- and species-specific and challenging to separate from background mortality). The areas that would be affected by the installation of structures, including their use of artificial lighting, do not contain unique pelagic habitats or communities that would be expected to differ from the remaining areas. Use of these areas would not result in any substantial, long-term changes to pelagic habitat function or use in the GOM. Further, the projected number of installed production structures is less than the number that is projected to be removed (**Table 3.3-2**), which would result in a presumed net reduction in the overall amount of offshore habitat modification/space use and associated artificial lighting on the OCS. In summary, the extensive movements of water masses that carry and mix plankton and *Sargassum* across the northern GOM, and their reproductive capabilities, support life histories that are resilient towards any localized or short-term adverse impacts expected to be associated with OCS oil- and gas-related routine activities or non-catastrophic spills and subsequent response activities associated with a single proposed OCS oil and gas lease sale.

Alternative C – Inflation Reduction Act Targeted OCS Lease Sale Area

Alternative C represents a geographical constraint on available acreage for leasing, which would cause a change in the spatial distribution of activities compared to Alternative B, but not their overall activity levels. Impacts to pelagic communities and habitats from routine OCS oil- and gas-related activities are not expected to occur in areas removed from potential leasing under Alternative C because, as discussed under Alternative B, areas of impacts from routine OCS oil- and gas-related activities occur within limited areas surrounding the activity, and these activities would not occur in excluded areas. Routine impacts would be limited to the areas leased under this alternative. The impacts from accidental events would be the same as described for Alternative B, including vessel strikes, which could occur in excluded areas because vessels could still transit the excluded areas. In addition, oil spills and response activities could occur in the excluded areas. This potential spatial redistribution of activity does not affect impact levels to pelagic communities and habitats, including *Sargassum*, because of their abundance and basin-wide distribution across the northern GOM. The areas that are part of the geographical constraint (i.e., approximately 28.7 million acres removed from potential leasing) do not contain unique pelagic habitats or communities that differ from the remaining areas, leaving impact determinations unchanged for Alternative C. In addition, the IPFs from routine activities are not changed from Alternative B.

Therefore, based on the description of the IPFs above and the scenario projections for a single proposed OCS oil and gas lease sale provided in **Chapter 3**, the overall impacts from IPFs associated with Alternatives C on pelagic communities and habitats, including *Sargassum*, would be **negligible** to **minor** in leased areas. This is due to the extensive movements of water masses that carry and mix plankton and *Sargassum* across the northern GOM, and their reproductive capabilities support life histories that are resilient towards localized or short-term adverse impacts. Any effects are expected to be localized and are not anticipated to reach a level that would have population-level effects to pelagic communities or detectable effects on GOM pelagic habitat function or use. In addition, lessees are required to perform OCS oil- and gas-related activities in accordance with regulatory requirements (**Table 4.5-2**), including post-lease water quality and air quality reviews that ensure compliance.

Alternative D – Targeted OCS Lease Sale Area with Additional Exclusions

Alternative D represents a geographical constraint on available acreage for leasing, which would cause a change in the spatial distribution of activities compared to Alternative B or C, but not their overall activity levels. Impacts to pelagic communities and habitats from routine OCS oil- and gas-related activities are not expected to occur in areas removed from potential leasing under Alternative D because, as discussed under Alternative B, areas of impacts from routine OCS oil- and gas-related activities occur within limited areas surrounding the activity, and these activities would not occur in excluded areas. Routine impacts would be limited to the areas leased under this alternative. The impacts from accidental events would be the same as described for Alternative B, including vessel strikes, which could occur in excluded areas because vessels could still transit the excluded areas. In addition, oil spills and response activities could occur in the excluded areas. This potential spatial redistribution of activity does not affect impact levels to pelagic communities and habitats, including *Sargassum*, because of their wide distribution across the northern GOM. The areas that are part of the geographical constraint (i.e., approximately 45.7 million acres removed from potential leasing) do not contain unique pelagic habitats or communities that differ from the remaining areas, leaving impact determinations unchanged for Alternative D. In addition, the IPFs from routine activities are unchanged from Alternative B.

Therefore, based on the description of the IPFs above and the scenario projections for a single proposed OCS oil and gas lease sale provided in **Chapter 3**, the overall impacts from IPFs associated with Alternative D to pelagic communities and habitats, including *Sargassum*, would be **negligible** to **minor** in leased areas. This is due to the extensive movements of water masses that carry and mix plankton and *Sargassum* across the northern GOM, and their reproductive capabilities, support life histories that are resilient towards localized or short-term adverse impacts. Any effects are expected to be localized and are not anticipated to reach a level that would have population-level effects to pelagic communities or detectable effects on GOM pelagic habitat function or use. In addition, lessees are required to perform OCS oil- and gas-related activities in accordance with regulatory requirements (**Table 4.5-2**), including post-lease water quality and air quality reviews that ensure compliance.

4.5.3 Incomplete or Unavailable Information

BOEM has identified incomplete or unavailable information that may be relevant to reasonably foreseeable impacts on pelagic communities and habitats, including *Sargassum*, related to underwater noise, climate change, and ocean acidification.

Study results have been mixed concerning the potential effects of underwater noise on plankton, including larvae, as a result of high-intensity sounds, especially when in close range (e.g., Carroll et al. 2017; Fields et al. 2019; McCauley et al. 2017; Richardson et al. 2017). Generally, limited spatial and temporal impacts have been found from equipment such as seismic air guns when evaluated (Richardson et al. 2017). Although the study results have been mixed, the results of these studies have been used to infer, similar to the conclusions of Vereide et al. (2023), that any effects from noise are likely to be stage- and species-specific and challenging to separate from background mortality. Further, the areas that would experience elevated noise levels comprise a relatively small proportion of the areas where plankton are distributed in the GOM.

Climate change impacts on *Sargassum* remain unknown as the habitat has a vast distribution. Increased temperatures could result in benefits to *Sargassum* by increasing the range where plants could be found and by increasing growth rates. Alternatively, potential water column stratification and changes in water current patterns could have negative effects by altering access to nutrients and/or moving *Sargassum* mats into unfavorable areas (Osborne et al. 2022). In March 2023, the amount of *Sargassum* in the Great Atlantic Sargassum Belt (extending from west Africa to the GOM) set a record abundance (approximately 13 million tons) for that time of year. Specific to the GOM, *Sargassum* quantity exceeded the 75th percentile for the same month between 2011 and 2022 (University of South Florida 2023). Thus, although the effects of climate change may vary, *Sargassum* habitat is not limited in the GOM.

Increased CO_2 uptake in pelagic waters could contribute to ocean acidification and plankton could be negatively affected as pH levels fluctuate. Any potential effects would be expected to vary by location and be stage- and species-specific. Under acidic conditions, typically evaluated in a laboratory setting, changes in plankton calcification rates, shell dissolution rates, physiology (e.g., photosynthesis and respiration), reproduction (e.g., egg production), and survival have been observed (Kim et al. 2016). However, determining the effects of ocean acidification in the northern GOM is challenging since it receives large freshwater and nutrient influxes that enhance carbonate chemistry variability (Osborne et al. 2022).

BOEM has determined that such information (described above) is not essential to a reasoned choice among alternatives and that the above studies were used in lieu of the information to indicate that potential effects are challenging to separate from background mortality, would vary by location, and would only affect a fraction of the plankton and *Sargassum* population that is abundantly distributed across the GOM. Ultimately, the extensive movements of water masses that carry and mix plankton and *Sargassum* across the northern GOM, and their reproductive capabilities, support life histories that are resilient towards localized or short-term adverse impacts, such as those expected to be associated with OCS oil- and gas-related routine activities or non-catastrophic spills and subsequent response activities. BOEM has used the best available scientific information to date and reasonably accepted scientific methodologies to extrapolate from existing information. Therefore, the incomplete or unavailable information, while relevant, would not likely change the impact conclusions reached in this analysis and is not essential to a reasoned choice among alternatives.

4.6 FISHES AND INVERTEBRATES

The GOM has a taxonomically and ecologically diverse assemblage of fishes and invertebrates due to its unique geologic, oceanographic, and hydrographic features. This assemblage consists of 1,541 fish species (including 51 shark and 42 ray and skate species), and over 13,000 species of invertebrates (Felder and Camp 2009; Ward and Tunnell Jr. 2017).

4.6.1 Affected Environment

Fishes of the GOM are generally temperate (Sherman et al. 1991), although an increasing number of tropical species are also found (Heck Jr. et al. 2015). Many fishes are year-round residents while some species occur only seasonally in the GOM or particular portions of the GOM (e.g., bluefin tuna [*Thunnus thynnus*]). The GOM is also home to several protected fishes (e.g., giant manta ray [*Manta birostris*] and oceanic whitetip shark [*Carcharhinus longimanus*]). Gulf sturgeon (*Acipenser oxyrinchus desotoi*) and smalltooth sawfish (*Pristis pectinata*) are unlikely to occur within the proposed OCS lease sale areas but do occur in coastal areas (smalltooth sawfish is primarily found off the coast of Florida). Nassau grouper (*Epinephelus striatus*) are considered rare or transient in the northwestern GOM.

Fish and invertebrate habitats of the GOM include estuaries, submerged aquatic vegetation, mangroves, marshes, algal flats, oyster reefs, coral and coral reefs, hard bottoms (i.e., exposed bedrock or authigenic carbonate relict reef), sand, shell, mud/silt/clay, open water, and deepwater benthic habitats. Soft bottom habitats are ubiquitous along the Gulf of Mexico OCS (~90%) whereas complex, hard bottom habitats that support diverse assemblages of fishes and invertebrates, including protected species and managed fisheries species, are less common (BOEM 2021b). For more information on fishes and invertebrates of the GOM, refer to Chapter 4.3.4.1 of the GOM Oil and Gas SID (BOEM 2023e) and Chapter 3.5 of BOEM's Biological Environmental Background Report (BOEM 2021b). Impacts to habitat-forming invertebrates (e.g., oysters and corals) are described and assessed in **Chapters 4.3 and 4.4**. Additional information regarding fish and invertebrate eggs and larvae in the water column can be found in **Chapter 4.5**.

4.6.2 Environmental Consequences

Fishes and invertebrates in the GOM are affected by existing environmental conditions, natural processes and phenomena, and human-induced factors. Chapter 4.3.4.1.3 of the GOM Oil and Gas SID describes the programmatic concerns influencing fishes and invertebrates: major storm events; land loss and sea-level rise; climate change; and invasive species. There are also several OCS oil- and gas-related activities and non-OCS oil- and gas-related activities that have the potential to impact fishes and invertebrates (**Table 4.6-1**). BOEM conducted an initial screening of IPFs in the GOM Oil and Gas SID and determined that discharges and wastes, bottom disturbance, noise, coastal land use/modification, lighting, offshore habitat modification/space use, unintended releases into the environment, response activities, and strikes and collisions could potentially impact fishes and invertebrates. These IPFs and their potential to affect fishes and invertebrates are discussed below and in greater detail in Chapter 4.3.4 of the GOM Oil and Gas SID. Supporting rationale for IPFs that were not analyzed in detail in this Programmatic EIS can also be found in Chapter 4.3.4 of the GOM Oil and Gas SID. New information released since the development of the GOM Oil and Gas SID and relevant to the analysis is included in the applicable chapters below.

Table 4.6-1. Impact-Producing Factors with the Potential to Impact Fishes and Invertebrates.

OCS Oil- and Gas-Related Routine Activities	OCS Oil- and Gas-Related Accidental Events	Non-OCS Oil- and Gas-Related Activities
Discharges and Wastes	Unintended Releases into the Environment	Air Emissions and Pollution
Bottom Disturbance	Response Activities	Discharges and Wastes
Noise	Strikes and Collisions	Bottom Disturbance
Coastal Land Use/Modification	-	Noise
Lighting and Visual Impacts	-	Coastal Land Use/Modification
Offshore Habitat Modification/ Space Use	-	Lighting and Visual Impacts
-	-	Offshore Habitat Modification/ Space Use
-	-	Climate Change

There are several existing regulatory programs and requirements that reduce or minimize the environmental effects of these IPFs to fishes and invertebrates in the GOM. Regulatory requirements enforced by BOEM, BSEE, and other agencies are outlined in **Table 4.6-2** and further described in the *Gulf of Mexico OCS Regulatory Framework* technical report (BOEM 2020a). Lessees are required to perform OCS oil- and gas-related activities in accordance with all regulatory requirements; therefore, this analysis factors in the mitigating effects of all applicable regulatory requirements as part of the proposed action when making impact determinations.

Table 4.6-2. Existing Regulatory Requirements and Protective Measures That Reduce the Potential Impacts of Impact-Producing Factors.

Regulatory Requirement or Protective Measure	Enforcing Agency	Impact-Producing Factor(s) Reduced/Avoided	Supporting References and Sections
Clean Water Act (NPDES Permits)	USEPA	Discharges and Wastes	Chapter 3.4.4
Marine Protection, Research, and Sanctuaries Act	USEPA	Discharges and Wastes	33 U.S.C. §§ 1401 *et seq*.
Hard Bottom Habitat Avoidance Mitigations	BOEM/BSEE	Bottom Disturbance	BOEM NTL No. 2009-G39; BOEM NTL No. 2009-G40

Regulatory Requirement or Protective Measure	Enforcing Agency	Impact-Producing Factor(s) Reduced/Avoided	Supporting References and Sections
National Marine Sanctuaries Act – Flower Garden Banks National Marine Sanctuary	NOAA	Discharges and Wastes; Bottom Disturbance; Noise; Unintended Releases into the Environment	15 CFR part 922 subpart L; 16 U.S.C. § 1434(d)
Magnuson–Stevens Fishery Conservation and Management Act (Essential Fish Habitat Consultation)	NOAA	Bottom Disturbance; Noise; Discharges and Wastes; Unintended Releases into the Environment	50 CFR part 600
Pollution Prevention	BSEE	Unintended Releases into the Environment	30 CFR § 250.300 (BSEE)
International Convention for the Prevention of Pollution by Ships (MARPOL 73/78), MARPOL Annex V Treaty	International Maritime Organization (IMO); USCG	Discharges and Wastes; Unintended Releases into the Environment	https://www.dco.uscg.mil/Our-Organization/Assistant-Commandant-for-Prevention-Policy-CG-5P/Inspections-Compliance-CG-5PC-/Commercial-Vessel-Compliance/Domestic-Compliance-Division/MARPOL/; 33 U.S.C. §§ 1901-1915; 33 CFR part 151 subpart A; Chapter 2.9.1.7 of the GOM Oil and Gas SID
Ballast Water Management for Control of Nonindigenous Species in Waters of the United States	USCG	Discharges and Wastes	33 CFR part 151 subpart A; Nonindigenous Aquatic Nuisance Prevention and Control Act of 1990 (16 U.S.C. §§ 4701-4751), as amended by the National Invasive Species Act of 1996
National Contingency Plan (CWA, Oil Pollution Act, National Oil and Hazardous Substances Pollution Contingency Plan)	USCG; USEPA; State, Regional, and local governments	Unintended Releases into the Environment (accidental oil spill)	40 CFR part 300, Section 311 Clean Water Act; Oil Pollution Act of 1990 (33 U.S.C. § 2701), the National Response Framework, Executive Orders 12580 and 12777, Secretarial Order 3299
Marine Debris Research, Prevention, and Reduction Act	USEPA, USCG	Unintended Releases into the Environment (accidental marine debris)	33 U.S.C. § 1901; OCS Report BOEM 2020-059, NMFS 2020 BiOp (NMFS 2020b) and amended ITS (NMFS 2021), Appendix B

4.6.2.1 OCS Oil- and Gas-Related Impact-Producing Factors from Routine Activities

Discharges and Wastes: The OCS oil- and gas-related activities in both offshore and onshore waterways result in operational discharges and wastes (e.g., sanitary wastes, drill muds and cuttings, and produced waters) that can impact fishes and invertebrates. These discharges are regulated through the NPDES general permits in support of the CWA (refer to **Chapter 3.4.1** for more information) as well as the Marine Protection, Research, and Sanctuaries Act (also referred to as the Ocean Dumping Act). Additionally, all vessels in U.S. and international waters are required to adhere to the International Maritime Organization's regulations under the International Convention for the Prevention of Pollution from Ships (MARPOL) limiting discharges, avoiding release of oily water, and prohibiting disposal of solid wastes. Ballast water may carry biological materials such as plants, animals, and microorganisms, which may introduce nonnative species. To prevent the spread of aquatic nuisance species, ballast water is subject to the USCG's Ballast Water Management Program, which implements the provisions of the Nonindigenous Aquatic Nuisance Prevention and Control Act of 1990, as amended by the National Invasive Species Act of 1996. BOEM places distancing mitigations (in accordance with distancing requirements determined through Essential Fish Habitat [EFH] consultation under the Magnuson-Stevens Fishery Conservation and Management Act and enforced by BSEE) on bottom-disturbing activities to protect sensitive benthic habitats. These mitigations may subsequently distance discharges and wastes from those habitats, thereby lessening potential impacts to the fishes and invertebrates utilizing them. Additionally, depending on the location of the proposed activities, an NMSA consultation may be required and could result in, for example, further distancing requirements for activities near the FGBNMS, which could similarly lessen potential impacts from discharges and wastes to fishes and invertebrates that inhabit the Sanctuary. Lessees are required to perform OCS oil- and gas-related activities in accordance with these regulatory and consultation requirements, as enforced by the agencies listed in **Table 4.6-2**.

While dispersion and rate of dilution of authorized discharges and wastes depends on several factors (e.g., discharge composition, discharge rate, and oceanographic conditions), most effects have been shown to remain within 1,000 m (3,281 ft) of the source for drilling fluids and cuttings and within several hundred meters for produced waters (Beyer et al. 2020; USEPA 2022a). Additionally, the regulation of discharges and wastes by the USEPA keeps contaminants in operational discharges and wastes below harmful levels, which can reduce the likelihood and severity of negative impacts to fishes and invertebrates. However, releases of discharges and wastes into the water column can still result in localized and temporary habitat degradation, biodiversity loss, and community structure shifts. Suspended materials may clog invertebrate feeding structures, resulting in injury or mortality (Abdul Wahab et al. 2017; Lissner et al. 1991). Increased turbidity can alter predation dynamics for fishes and invertebrates by either enhancing or decreasing predator feeding efficiency, potentially leading to changes in community structure or growth and condition of larvae (Benfield and Minello 1996; Chesney et al. 2000; De Robertis et al. 2003; Jönsson et al. 2013; Lunt and Smee 2014; Lunt and Smee 2020; Minello et al. 1987). Sedimentation can smother benthic species with little to no mobility, potentially resulting in injury or mortality, whereas highly mobile species are expected to be able to avoid large discharge plumes.

Bottom Disturbance: Bottom disturbance associated with OCS oil-and gas-related activities (e.g., anchoring and drilling) can directly impact fishes and invertebrates by crushing individuals with limited or no mobility and exposing infauna, making them more vulnerable to predation. Sediments suspended into the water column during bottom-disturbing activities increase turbidity and cause sedimentation, resulting in potential effects similar to those discussed earlier under discharges and wastes. Fish eggs and larvae are unable to avoid sediment plumes, which may result in reduced oxygen uptake in eggs and hatching success (Gray et al. 2012), and physical or visual impairment of larvae during feeding (Axler et al. 2020). BOEM places distancing mitigations (in accordance with distancing requirements determined through EFH consultation and enforced by BSEE) on bottomdisturbing activities to protect sensitive, slow-to-recover hard bottom habitats. These mitigations reduce the potential for fishes and invertebrates associated with hard bottom habitats to be negatively impacted by disallowing destruction of hard bottom features and distancing turbidity and sedimentation effects. Depending on the location of the proposed activities, an NMSA consultation may be required and could result in additional mitigations for hard bottom habitat (e.g., further distancing requirements). Bottom disturbance is not mitigated for soft bottoms, and damage to these habitats and associated fishes and invertebrates may still occur. However, soft bottom communities are far more common in the GOM and generally recover relatively quickly (3 months to 2.5 years) in comparison to hard bottom communities (8-10 or more years) (Brooks et al. 2006; Rogers and Garrison 2001; Tamsett et al. 2010; Wilber and Clarke 2007).

Noise: All OCS oil- and gas-related activities (e.g., seismic airgun surveys and explosive decommissioning) have an element of sound generation that can stimulate a behavioral response in fishes and invertebrates, and mask biologically important signals, cause temporary or permanent hearing loss, or mortality in fishes (de Soto 2016; Popper et al. 2014b; Popper et al. 2005). Generally, studies of impulsive sound, such as seismic airguns, have shown that injury and temporary threshold shifts in hearing are possible, but species without hearing specializations (e.g., ESA-listed giant manta rays and oceanic whitetip sharks) are less likely to sustain effects, and even those with some specializations are likely to recover within several days of exposure (Hastings et al. 2008; McCauley and Kent 2012; McCauley et al. 2008; Popper et al. 2005). Both effects are expected to be short-term and occur very close to the source (i.e., within tens of meters; Popper et al. 2014b). Fish larvae may experience injury, reduced growth, or mortality if located within 10 m (100 ft) of an air gun blast (Turnpenny and Nedwell 1994). For adult fish, sound produced from seismic airguns has been found to result in only subtle, short-term behavioral changes with no evidence that fish are fleeing an area, ceasing feeding, or permanently abandoning habitat (Davidsen et al. 2019; Hubert et al. 2020; Meekan et al. 2021). For explosive severance (e.g., platform decommissioning), the resulting rapid oscillation in the pressure waveform can cause rapid contraction and overextension of the swim bladder for many GOM fishes (e.g., snappers, groupers, tilefishes, and jacks), potentially resulting in mortality. However, studies of the effects of noise from explosive platform removal have indicated that the level of activity and resulting mortalities does not substantially alter stock levels of several recreationally and commercially important fishes (Gallaway et al. 2020; Gitschlag et al. 2001). BOEM places distancing mitigations (in accordance with distancing requirements determined through EFH consultation and enforced by BSEE) on bottom-disturbing activities to protect sensitive benthic habitats, which may subsequently reduce noise impacts to fishes and invertebrates that utilize those habitats. The NMSA consultations for activities near the FGBNMS may also result in additional mitigations to those already applied by BOEM and BSEE (e.g., further distancing requirements). These mitigations could minimize or avoid impacts to Sanctuary resources, such as protected species (e.g., giant manta ray) and rare fishes (e.g., marbled grouper), from noise that could otherwise result in the masking of biologically important sounds used for communication between individuals or behavioral impacts (e.g., fleeing or freezing) during sensitive periods (e.g., spawning).

Coastal Land Use/Modification: Coastal land disturbance from OCS oil- and gas-related activities includes navigation canal dredging, the construction of new onshore facilities and pipeline landfalls, and vessel traffic. These activities could impact fishes and invertebrates in similar ways as described above for discharges and wastes (e.g., reduced water quality), bottom disturbance (e.g., crushing and increased turbidity), and noise (e.g., masking from vessel traffic). The amount of coastal construction or dredging associated with new OCS oil- and gas-related activities is relatively low as infrastructure is already largely in place (**Chapter 3**). However, dredging could still occur as a result of the proposed action and result in changes to habitat availability and quality, as well as injury and mortality to fishes and invertebrates in the area of impact. Coastal construction and vessel traffic can contribute to shoreline erosion and operational discharges and wastes, leading to localized habitat degradation and increases in turbidity and sedimentation. Federal channels and canals are maintained throughout the relevant onshore area by the USACE, State, county, commercial, and private interests. The USACE is charged with maintaining all larger navigation channels in the area of interest.

Lighting: The OCS oil- and gas-related structures and equipment, such as platforms, vessels, and onshore facilities, can emit artificial light into the marine environment that attracts mobile fishes and invertebrates. For example, Shaw et al. (2002) found that artificial lighting at night emitted from offshore platforms in the northern GOM attracts and results in elevated levels of zooplankton and ichthyofauna, which, in turn, attracts post-larval and juvenile pelagic fishes and pre-settlement stages of soft bottom taxa. While the long-term effects of attraction of fishes and invertebrates are unclear, short-term effects include altering community composition, concentrating predators near lit surface waters, and modifying schooling and predatory behaviors (Barker and Cowan Jr. 2018). It is also thought that artificial lighting at night may disproportionately benefit certain predatory species that rely on visual cues for prey capture rather than predators that rely on other sensory cues (Martin et al. 2021).

Offshore Habitat Modification/Space Use: The OCS oil- and gas-related activities can include placement of infrastructure on the Gulf of Mexico OCS (e.g., platforms, pipelines, and pipeline end manifolds). These structures encourage the colonization of encrusting invertebrates that attracts higher trophic level organisms, including various life stages of fishes and invertebrates, resulting in community structure shifts, changes in predator/prey interactions, and potential changes to migratory patterns (Snodgrass et al. 2020; van Elden et al. 2019). In addition, artificial substrates can assist in the spread of invasive species that can outcompete native species and alter predator/prey interactions. Fishing activity may increase at easily accessible OCS oil- and gas-related structures, resulting in injury or mortality of fishes and invertebrates, particularly managed fisheries species known to utilize artificial structures (e.g., snappers, jacks, groupers, and tunas). The eventual decommissioning of these structures can result in community changes (i.e., removal of artificial habitat, causing reductions in biodiversity). Protected fishes on the OCS such as Nassau grouper, giant manta rays and oceanic whitetip sharks are not known to reside on or be attracted to OCS oil- and gas-related structures, and are therefore not likely to be affected.

4.6.2.2 OCS Oil- and Gas-Related Impact-Producing Factors from Accidental Events

Unintended Releases into the Environment: BSEE requires that lessees take measures to prevent unauthorized discharge of pollutants into offshore waters (30 CFR § 250.300). Additionally, the International Maritime Organization's regulations under the International Convention for the Prevention of Pollution from Ships (MARPOL), the National Contingency Plan, and the Marine Debris Research, Prevention, and Reduction Act contain regulations and guidance to prevent, minimize, and/or respond to accidental pollution from ships. However, unintended releases such as oil spills can still occur and adversely impact fishes and invertebrates. Exposed eggs and larvae may risk delayed development or abnormalities, resulting in decreased fitness and reduced survival rates (Fucik et al. 1995; Incardona et al. 2014; Mager et al. 2014). Damage to the central nervous system and impaired decisionmaking may also occur among juveniles (Schlenker et al. 2022). Impacts to mobile, adult fish would likely be sublethal as they can generally avoid adverse conditions, metabolize hydrocarbons, and excrete metabolites and parent compounds (Lee et al. 1972; Snyder et al. 2019). However, lasting sublethal effects from oil exposure can include sensory system impairment, constrained development, reduced reproductive success, decreased energy budgets, and reduced survival (Schlenker et al. 2022). Although vessel and platform operators are required to take preventative measures against the loss of marine trash and debris, accidental releases may still occur. Marine debris can degrade in the environment and become microdebris (i.e., small synthetic, semi-synthetic, or naturally-derived particles), which can be ingested by fishes and invertebrates, resulting in pseudo-satiation or physical blockage (Lestrade and Hernandez 2023). Ingestion of microplastics, a type of microdebris, can result in emaciation and toxin exposure, leading to decreased growth, reproduction, and survival of fishes and invertebrates (Enyoh et al. 2020; Foley et al. 2018; Gad and Midway 2022; Waddell et al. 2020). Microdebris accumulation in seafloor sediments and *Sargassum* habitat results in benthic, benthopelagic, and *Sargassum*-associated fishes (e.g., juvenile jacks and triggerfish) being particularly vulnerable to exposure and ingestion (Lestrade and Hernandez 2023). BOEM's distancing mitigations (in accordance with distancing requirements determined through EFH consultation and enforced by BSEE) on bottom-disturbing activities from hard bottom habitats may lessen impacts from accidental spills and debris to hard bottom-associated fishes and invertebrates. The NMSA consultations for activities near the FGBNMS may also result in additional mitigations to those already applied by BOEM (e.g., further distancing requirements).

Response Activities: Dispersants used in response to an accidental oil spill could increase the water solubility of petroleum hydrocarbons, increasing their bioavailability for uptake by fishes and invertebrates (Johann et al. 2021; Wolfe et al. 2001). This uptake could result in negative effects, including behavioral responses, delayed development, and mortality (Jasperse et al. 2018; Laramore et al. 2016). *In-situ* burning may result in less harmful overall effects to fishes and invertebrates due to its combustion of a large volume of oil (Johann et al. 2021). However, the toxicity of compounds resulting from *in-situ* burning may remain the same as an unweathered slick or be altered but depends on many factors including oil type, burn efficiency, and susceptibility of particular organisms (Fritt-Rasmussen et al. 2015; Johann et al. 2021). Early life stages of invertebrates and fishes beneath the surface are not likely to be affected by *in-situ* burning residue; however, sunken residue may result in negative effects for benthic biota (Buist et al. 1999). Fishes and invertebrates would generally be expected to be able to avoid mechanical spill-response techniques (e.g., booms), but trapping of organisms, particularly surface-dwelling organisms (e.g., pelagic eggs and larvae, and juvenile and adult fishes and invertebrates that inhabit *Sargassum* habitats or floating debris), could occur and result in injury or mortality (e.g., physical crushing by towed boom and/or increased oil contact).

Strikes and Collisions: Strikes and collisions from vessels associated with OCS oil- and gas-related routine activities are very unlikely to affect the majority of fishes and invertebrates of the GOM. However, there is a possibility for vessels to strike large, surface-feeding fish such as whale sharks *(Rhincodon typus*) that aggregate to feed during the summer in the north-central GOM (Chen 2017; Hoffmayer et al. 2007; McKinney et al. 2017). Pelagic fish and invertebrate early life stages (e.g., eggs, larvae, and juveniles) near the surface may also experience mortality from vessel strikes or may be temporarily displaced by vessel wake due to their limited mobility.

4.6.2.3 Alternatives Analysis

Alternative A – No Action (Cancellation of a Single Proposed OCS Oil and Gas Lease Sale)

Under Alternative A, a proposed OCS oil and gas lease sale would not occur so there would be no new routine activities or accidental events resulting from the proposed action. Therefore, the impacts would be **none** since no direct or indirect impacts to fishes and invertebrates would occur as a result of the proposed action (i.e., a single proposed OCS oil and gas lease sale). However, there are ongoing OCS oil- and gas-related activities and other non-OCS oil- and gas-related activities that contribute to the baseline environment (summarized in **Chapter 4.0.1** of this Programmatic EIS and described in detail in Chapter 3 of the GOM Oil and Gas SID) that would still occur. Ongoing activities associated with previous OCS oil and gas lease sales (**Table 3.3-2**) could still have potential direct impacts to fishes and invertebrates through discharges and wastes, bottom disturbance, coastal land use/modification, light and visual impacts, noise, offshore habitat modification/space use, unintended releases into the environment, response activities, and strikes and collisions, as summarized above in **Chapter 4.6.2.2** and evaluated as part of the cumulative analysis in **Chapter 4.17.6**.

Comparison of Impacts under Alternatives B, C, and D

A proposed regionwide OCS oil and gas lease sale under Alternatives B through D, and the resulting OCS oil- and gas-related development on any subsequent leases from the proposed OCS lease sale, could result in discharges and wastes, bottom disturbance, noise, coastal land use/modification, lighting, offshore habitat modification/space use, unintended releases into the environment, spill response, and strikes and collisions that could potentially impact fishes and invertebrates, including ESA-listed species.

Alternative B represents the largest geographic area under consideration for a proposed regionwide OCS lease sale. Alternatives C and D represent geographical constraints on available acreage for leasing, which could change the spatial distribution of the scenario activities but not their overall activity levels. Therefore, this alternative's analysis is focused on the potential environmental impacts of a proposed regionwide OCS lease sale (Alternative B) and then considers if these potential impacts could be reduced by the geographic constraint under each alternative considered (Alternatives C and D).

Table 4.6-3 shows the impact determinations for each IPF that affects fishes and invertebrates for each alternative analyzed. Impacts are shown both with and without BOEM's protective measures applied, if a BOEM protective measure being considered in this Programmatic EIS is applicable to that IPF. The impacts of Alternative A are not shown in the **Table 4.6-3** because the impacts are **none** for all IPFs.

Table 4.6-3. Impact Determinations for Routine and Accidental Impacts to Fishes and Invertebrates for Alternatives B-D.

Impact-Producing Factor	BOEM's Protective Measure[1]	Alternative B	Alternative C	Alternative D
Discharges and Wastes	N/A	**Negligible**	**Negligible**	**Negligible**
Bottom Disturbance	Without Protective Measures	**Moderate**	**Moderate**	**Moderate**
Bottom Disturbance	With Protective Measures	**Minor**	**Minor**	**Minor**
Noise	N/A	**Negligible** to **Moderate**	**Negligible** to **Moderate**	**Negligible** to **Moderate**
Coastal Land Use/Modification	N/A	**Minor**	**Minor**	**Minor**
Lighting and Visual Impacts	N/A	**Negligible** to **Minor**	**Negligible** to **Minor**	**Negligible** to **Minor**
Offshore Habitat Modification/ Space Use	N/A	**Negligible** to **Minor**	**Negligible** to **Minor**	**Negligible** to **Minor**
Unintended Releases into the Environment	N/A	**Negligible** to **Moderate**	**Negligible** to **Moderate**	**Negligible** to **Moderate**
Response Activities	N/A	**Negligible** to **Minor**	**Negligible** to **Minor**	**Negligible** to **Minor**
Strikes and Collisions	N/A	**Negligible**	**Negligible**	**Negligible**

Note: Alternative A is not shown in the table because the impacts from all impact-producing factors is **none**.

[1] Protective measures for application at the OCS lease sale stage are being contemplated in this Programmatic EIS. Additional BOEM protective measures for fishes and invertebrates would be considered at the site-specific stage.

Alternative B – Regionwide OCS Lease Sale

Alternative B considers a proposed regionwide OCS lease sale area. Within this geographic area, impacts may affect a variety of fishes and invertebrates (including estuarine, coastal, continental shelf, continental slope, and abyssal plain taxa), including ESA-listed species such as Nassau grouper, giant manta ray, oceanic whitetip shark, smalltooth sawfish, and Gulf sturgeon. While estuarine and coastal areas are not included in the proposed OCS lease sale area, impacts from the proposed action may extend to coastal areas due to vessel transit, onshore support, and the connectivity of water bodies. Gulf sturgeon and smalltooth sawfish are unlikely to occur within the proposed OCS lease sale area but do occur in coastal areas (the smalltooth sawfish is primarily found off the coast of Florida). The majority of the EPA is excluded from leasing under this alternative, which greatly reduces or eliminates potential impacts to fishes and invertebrates in the northeastern GOM (i.e., along Florida). Portions of the FGBNMS would be excluded from leasing under this alternative (whole and partial blocks of the West, East, and Stetson Banks), which would reduce potential impacts to taxa that utilize or solely inhabit the Sanctuary. For example, although Nassau groupers are considered rare or transient in the northwestern GOM, they have been sighted in the FGBNMS at both the East and West Flower Garden Banks (Foley et al. 2007). Giant manta rays are also found in the FGBNMS; however, while the leasing exclusion may offer them some protection, they also frequent and likely utilize other banks and hard bottom habitats for nursery habitat that are not excluded from leasing under this alternative (i.e., topographic features or pinnacles) (Childs 2001; Stewart et al. 2018).

Discharges and Wastes: Discharges and wastes can occur from any routine oil and gas activity except for helicopter operations (**Table 3.3-4**). Given the level of these activities described in **Table 3.3-2** for a single proposed OCS oil and gas lease sale to occur over a 40-year lifespan, impacts to fishes and invertebrates, including ESA-listed species, are expected to be relatively undetectable and therefore **negligible**. Due to the likely rapid dispersal of suspended materials via current and wave action, applied USEPA regulations, and basin-wide distribution of fish and invertebrate populations, water quality would be expected to return to baseline conditions within a short period of time, leaving no measurable or detectable impacts to fishes or invertebrates.

Bottom Disturbance: Based on the description of the potential impacts above and the expected amount of activity that would cause bottom disturbance as described in **Table 3.3-2**, impacts from bottom disturbance to fishes and invertebrates, including ESA-listed species and the habitats on which they rely, are expected to be **moderate** if unmitigated and allowed to directly contact sensitive hard bottom habitats. Notable, localized adverse impacts to the extent and quality of habitat for species common to the project area and ESA-listed species could occur. However, impacts to hard bottom habitats, including pinnacles and topographic features, are mitigated by BOEM via applied distancing mitigations. Further, NMSA consultations for activities occurring in the vicinity of the FGBNMS could potentially result in additional distancing mitigations. Mitigated impacts to fishes and invertebrates would therefore be highly localized, **minor**, and mainly impact soft-sediment communities that are generally expected to fully recover after disturbance within a relatively short period of time.

Noise: Noise from OCS oil- and gas-related activities may result in **negligible** to **moderate** impacts to fishes and invertebrates, including ESA-listed species, depending on a variety of factors (e.g., source type and the species' hearing sensitivity). Impacts could range from undetectable to acute changes in behavior, recoverable injury, and/or mortality of individuals (not expected for protected species). Impacts from seismic airgun sound to invertebrates and fishes without hearing specializations would largely be undetectable and negligible. While impacts could still occur to sensitive fishes (i.e., those with swim bladders and hearing specializations), the individuals would have to be very close to the source to be impacted and, therefore, no mortality is anticipated. Impacts to hearing structures would be temporary and recoverable. This, combined with the anticipated amount of G&G survey activities (**Table 3.3-2**) for a single proposed OCS oil and gas lease sale over a 40-year lifespan, renders potential impacts highly localized. A negligible quantity of mortalities to floating eggs/larvae may occur (**Chapter 4.5**). Mortalities of managed fisheries species (e.g., red snapper) from explosive decommissioning activities could occur for species present on or near platforms; however, given the anticipated number of explosive removals (**Table 3.3-2**) for a single proposed OCS oil and gas lease sale over a 40-year lifespan, the associated mortalities are not expected to result in stock- or population-level impacts. Although Alternative B would allow leasing in areas of the expanded FGBNMS, additional mitigations (e.g., distancing requirements) may be imposed through consultation under the NMSA, which may provide additional protection for FGBNMS fishes and invertebrates, including the ESA-listed species that utilize those banks.

Coastal Land Use/Modification: Impacts from coastal land use/modification to fishes and invertebrates, including ESA-listed species, are expected to be **minor** as industrial infrastructure is already largely in place (including support and helicopter bases). The relative amount of expected additional vessel traffic and pipeline installation (**Table 3.3-2**) could result in highly localized impacts to estuarine fishes and invertebrates and the coastal habitats that support them via shoreline erosion (i.e., habitat loss and increased turbidity and sedimentation), noise, discharges and wastes, and bottom disturbance. Refer to **Chapter 4.3** for more information on potential impacts to coastal fish and invertebrate habitats.

Lighting: Impacts from lighting to fishes and invertebrates, including ESA-listed species, are expected to be **negligible** to **minor** due to the relatively small amount of oil- and gas-related vessel traffic (and its transient nature) and anticipated number of emplaced structures (**Table 3.3-4**) associated with a single proposed OCS oil and gas lease sale over a 40-year lifespan. Any artificial lighting at night input into the environment as a result of the proposed action could potentially result in either no measurable impacts or result in localized differences to species richness or abundance of species common to the proposed project area.

Offshore Habitat Modification/Space Use: Impacts from offshore habitat modification/space use would be **negligible** to **minor**. Emplaced OCS oil- and gas-related structures (e.g., platforms and pipelines) would primarily function as attracting devices for invertebrates and a variety of fishes, resulting in potential effects as described previously. Considering the number of structures that could be installed as a result of a single proposed OCS oil and gas lease sale (**Table 3.3-2**), effects to most fishes and invertebrates would be **minor** because localized changes to species richness or abundance could occur. Impacts to ESA-listed fish would be undetectable and **negligible**, as protected fishes on the OCS such as Nassau grouper, giant manta rays, and oceanic whitetip sharks are not known to reside on or be attracted to offshore oil- and gas-related structures.

Unintended Releases into the Environment: Impacts from unintended releases into the environment to fishes and invertebrates, including ESA-listed species, are anticipated to be **negligible** to **moderate**. Due to the mitigating measures mentioned above in **Chapter 4.6.2.2**, impacts from trash and marine debris tied to a single proposed OCS oil and gas lease sale would be largely undetectable and negligible. The likely amount of marine debris accidentally released attributable to a single OCS oil and gas lease sale is expected to be small, but it would contribute to the cumulative impacts discussed below. Non-oil spills (e.g., chemical spills and synthetic-based fluid spills) would likely be relatively infrequent based on the occurrences of these accidental spills calculated over the past decade (**Tables 3.5-2 and 3.5-3**). Impacts would likely be highly localized, and mobile fishes and invertebrates would be expected to be able to largely avoid areas of impact. Based on the number and volume of accidental oil spills estimated for a single proposed OCS oil and gas lease sale (**Chapter 3.5.1.1**), negative impacts to fishes and invertebrates could range from undetectable (**negligible**) to **moderate**, resulting in notable and measurable localized adverse impacts to habitat and fish and invertebrate abundance and richness. Risk of toxicity and the potential for mortality (either directly or indirectly) would be greatest at spill onset, decreasing over time via spill weathering and biodegradation. Mobile fishes and invertebrates would likely be able to escape impacts more readily than slow-moving, benthic taxa.

Response Activities: Impacts from response activities to fishes and invertebrates, including ESA-listed species, are expected to be **negligible** to **minor** as response activities would occur in a limited area and many mobile fishes and invertebrates would be able to avoid mechanical spill containment and cleanup methods. While it may be more difficult for fishes and invertebrates to avoid response activities for spills that reach semi-enclosed areas (e.g., bays and estuaries), any impacts to habitat quality would still be highly localized and minor.

Strikes and Collisions: Impacts from strikes and collisions to fishes and invertebrates, including ESA-listed species, are expected to be largely undetectable and **negligible** due to the anticipated amount of service vessel traffic associated with a single proposed OCS oil and gas lease sale (**Table 3.3-2**), particularly when compared with other non-OCS oil- and gas-related vessel traffic in the GOM and the added unlikelihood of ships contacting most fishes and invertebrates at the surface.

Therefore, based on the description of the IPFs above and the scenario projections for a single proposed OCS oil and gas lease sale provided in **Chapter 3**, the overall impacts from IPFs associated with Alternative B on fishes and invertebrates would be **moderate** without mitigating measures. When mitigating measures are utilized, particularly BOEM hard bottom distancing mitigations, impacts would be **minor** because the distancing of activities lessens the severity of or avoids negative impacts to fishes and invertebrates associated with these sensitive, slow to recover habitats.

Alternative C – Inflation Reduction Act Targeted OCS Lease Sale Area

Under Alternative C, the spatial distribution of activities would change from Alternative B but not the overall anticipated levels of activity. Blocks subject to the Topographic Features and Live

Bottom (Pinnacle Trend) Stipulations; Blocks South of Baldwin County, Alabama, Stipulation; Significant Sediment Resource Areas; Wind Energy Area Options and Final Wind Energy Areas; and the Rice's whale core distribution area and proposed critical habitat would additionally be removed from consideration. Of these, removal of the Topographic Features Stipulation and Live Bottom (Pinnacle Trend) Stipulation blocks may have a small difference in impacts to fishes and invertebrates since it would result in even greater distancing of activities and resulting IPFs (e.g., turbidity, sedimentation, noise, light, habitat modification, and spills and spill response) to these hard bottom features due to the whole and partial block restrictions. This could potentially provide greater protection for fish and invertebrate taxa, including ESA-listed species that utilize these habitats (e.g., giant manta rays and Nassau grouper). Overall, however, the spatial redistribution of activity under Alternative C would not change the suite of IPFs and impact conclusions for fishes and invertebrates, including ESA-listed species, from those under Alternative B because activities in these areas would already have distancing mitigations placed on them by BOEM during the activity review process. Further, any activities occurring in the vicinity of the expanded FGBNMS would likely require consultation under the NMSA and could result in additional and more stringent mitigations to those already applied by BOEM.

Therefore, based on the description of the IPFs above and the scenario projections for a single proposed OCS oil and gas lease sale provided in **Chapter 3**, the overall impacts from IPFs associated with Alternative C on fishes and invertebrates would be **moderate** without mitigating measures. When mitigating measures are utilized, particularly BOEM's hard bottom distancing mitigations, impacts would be **minor**.

Alternative D – Targeted OCS Lease Sale Area with Additional Exclusions

The spatial redistribution of activity under Alternative D would not change impact conclusions for fishes and invertebrates, including ESA-listed species, from those under Alternatives B and C. Under this alternative, in addition to exclusions under Alternatives B and C, whole and partial expanded FGBNMS (as of March 22, 2021) blocks, whole and partial EPA blocks, whole and partial Wind Call Area blocks, whole and partial DOD mission incompatibility blocks, and whole and partial OCS blocks shoreward of the 20-m (66-ft) isobath would be excluded from leasing. Of these, the exclusion of expanded FGBNMS blocks and blocks shoreward of the 20-m isobath may have implications for fishes and invertebrates. However, the expanded FGBNMS blocks are already included in BOEM's topographic features blocks (excluded under Alternative C) and subject to BOEM's hard bottom distancing mitigations. Further, any activities occurring in the vicinity of the expanded FGBNMS may require consultation under the NMSA and could result in additional and more stringent mitigations to those already applied by BOEM. While the 20-m isobath exclusion may potentially reduce the amount of impact specific to coastal and estuarine species by further distancing allowable leasing to seaward of the 20-m isobath (e.g., further distancing offshore activities), the suite of IPFs would remain unchanged since activity levels also remain unchanged in all water-depth categories (e.g., vessel traffic or pipeline installations in the 0- to 60-m [0- to 197-ft] depth category). The suite of IPFs and impact conclusions therefore remain unchanged from Alternatives B and C due to BOEM's mitigations and additional environmental consultations (e.g., NMSA).

Therefore, based on the description of the IPFs above and the scenario projections for a single proposed OCS oil and gas lease sale provided in **Chapter 3**, the overall impacts from IPFs associated with Alternative D on fishes and invertebrates would be **moderate** without mitigating measures. When mitigating measures are utilized, particularly BOEM's hard bottom distancing mitigations, impacts would be **minor**.

4.6.3 Incomplete or Unavailable Information

BOEM has identified incomplete or unavailable information that may be relevant to reasonably foreseeable impacts on fishes and invertebrates, including ESA-listed species. The response of individuals, groups of conspecifics (members of the same species), and communities of fishes and invertebrates to anthropogenic sound are highly variable and species-specific; and little information is known for GOM-specific taxa, but inferences can be drawn from studies of similar taxa in other regions. Limited information is available regarding the long-term effects of PAH uptake (from oil exposure) on particular taxa, including chronic exposure for benthic species that burrow (e.g., tilefishes and flounders). However, since the *Deepwater Horizon* oil spill occurred in 2010, while there have been generally consistent findings of significant impacts from oil exposure to fishes and invertebrates at the individual or organismal level, fish and invertebrate populations have remained relatively stable despite the unparalleled perturbation (Patterson III et al. 2023; Swinea and Fodrie 2021). The effects of artificial light on fish behavior are difficult to tease apart from other contributing factors in the offshore environment and may warrant further study, but the total volume of water illuminated by artificial lighting at night in the northern GOM is small compared to the available habitat, and no effects are expected to result in population-level impacts at this time. Finally, the effects of ocean acidification to GOM fishes and invertebrates are complicated to determine and tease apart from other sources, since the northern GOM receives large freshwater and nutrient influxes that enhance carbonate chemistry variability (Osborne et al. 2022). Although additional information on these IPFs may be relevant to the evaluation of impacts, BOEM has determined that such information is not essential to a reasoned choice among alternatives. BOEM used the best available science to determine the range of reasonably foreseeable impacts and applied accepted scientific methodologies to integrate existing information and extrapolate potential outcomes in completing this analysis and formulating the conclusions presented here.

4.7 BIRDS

Several bird groups utilize the U.S. Gulf of Mexico environment, as the area serves multiple habitat and life staging purposes. Birds from six distinct taxonomic and ecological groups are represented within the GOM region, including passerines (i.e., Passeriformes), raptors (i.e., Falconiformes, Accipitriformes), seabirds (i.e., Charadriiformes, Pelecaniformes, Procellariiformes, Gaviiformes, Podicipediformes), waterfowl (i.e., Anseriformes, Gaviiformes), shorebirds (i.e., Charadriiformes), and wading or marsh birds (i.e., Ciconiiformes, Gruiformes).

Currently, nine federally listed protected bird species occur in the northern GOM: Cape Sable seaside sparrow; Mississippi sandhill crane; piping plover; rufa red knot; roseate tern; whooping crane; wood stork; eastern black rail; and black-capped petrel. The FWS also lists species as candidate species when it has enough information on their biological status and threats to propose them as ESA-listed, but for which other higher priority listing activities preclude the development of a proposed listing regulation. These species do not receive statutory protection under the ESA. There are several candidate bird species identified in the northern GOM (FWS 2023), including the golden-winged warbler and the saltmarsh sparrow. For more information on these species, refer to Chapter 4.3.5.1 of the GOM Oil and Gas SID and Chapter 3.8 of BOEM's Biological Environmental Background Report (BOEM 2021b).

4.7.1 Affected Environment

Both resident and migratory bird species rely heavily on the marine (i.e., pelagic waters) and coastal habitats (i.e., beaches, mudflats, salt marshes, coastal wetlands, and embayments) found in the GOM region. Resident species are present throughout the year and do not migrate. Many passerines, or songbirds, breed and winter in the Gulf Coast States, and can be found in the coastal area and offshore during the trans-Gulf migration in the fall and spring. Other bird species, mainly seabirds, live primarily offshore, except during their breeding season. These pelagic birds, including shearwaters, storm-petrels, boobies, gannets, jaegers, gulls, and terns (Duncan and Havard 1980), rely specifically on offshore waters for food and rest at stop-over sites. The remaining species found in the GOM region are generally located within coastal and inshore habitats.

The GOM is an essential area for migratory birds, as three of the four major flyways (refer to Figure 4.3.5-1 of the GOM Oil and Gas SID) occur within the Gulf of Mexico (the Central, Mississippi, and Atlantic Flyways). Areas of these flyways are used by hundreds of millions of migratory birds, many of whom converge within the diverse coastal and terrestrial habitats in the northern GOM which is an important area for migratory species that travel in large numbers in the fall and spring (Russell 2005). Roughly 40 percent of all North American migrating waterfowl and shorebirds use the Mississippi Flyway (FWS 2013), which runs through the peninsula of southern Ontario to the mouth of the Mississippi River followed by a comparably short distance across the GOM. During this highly energetic period, stop-over sites are critical to migratory birds. These areas provide resting and feeding opportunities (Brown et al. 2001; McWilliams and Karasov 2005).

Species abundance in the GOM varies seasonally due to migration and breeding times. Abundance can also be driven by mesoscale features, such as the Mississippi River freshwater plume and dynamic oceanic fronts and eddies (Bost et al. 2009; Ribic et al. 1997; Scales et al. 2014) (refer to Chapter 3.0 of BOEM's Biological Environmental Background Report). Seabirds have a K-selected life history strategy, which means they are species that produce few offspring but invest high amounts of parental care. As such, seabird population levels can be impacted by natural climate cycles and anthropogenic activities (Paleczny 2012). For more information, including a detailed description of birds in the GOM, refer to Chapter 4.3.5.1 of the GOM Oil and Gas SID and Chapter 3.8 of BOEM's Biological Environmental Background Report (BOEM 2021b).

There is designated critical habitat for four of the protected species that occur in the GOM: Cape Sable seaside sparrow; Mississippi sandhill crane; piping plover; and whooping crane. A critical habitat rule has been proposed for the rufa red knot, including designations for coastal wintering areas of the Gulf Coast States (88 FR 22530).

Federally listed species are considered and analyzed in consultations with the FWS (refer to the 2018 FWS BiOp and **Appendix A** of this Programmatic EIS). Seven of these species (i.e., the Mississippi sandhill crane, piping plover, rufa red knot, whooping crane, wood stork, eastern black rail, and the black-capped petrel) are found along the coast of Texas, Louisiana, Mississippi, and Alabama, where there are higher levels of OCS oil- and gas-related activities. Two of the listed species have ranges along the southwest coast of Florida (i.e., the Cape Sable seaside sparrow and roseate tern), where they are not likely to be impacted by BOEM-regulated activities.

4.7.2 Environmental Consequences

Birds in the GOM are affected by existing environmental conditions, natural processes and phenomena (e.g., hurricanes), and human-induced factors. Chapter 4.3.5.1 of the GOM Oil and Gas SID describes the programmatic concerns influencing birds: collisions with human-made structures; predation by domestic cats; emerging infectious diseases; overexploitation of prey; climate change; and ocean acidification. There are also several OCS oil- and gas-related activities and additional non-OCS oil- and gas-related activities that have the potential to impact birds (refer to **Table 4.7-1**). BOEM conducted an initial screening of IPFs in the GOM Oil and Gas SID and determined that discharges and wastes, noise, coastal land use/modification, lighting and visual impacts, offshore habitat modification/space use, unintended releases into the environment, response activities, and strikes and collisions could potentially impact birds. These IPFs and their potential to affect birds are discussed below and in greater detail in Chapters 4.3.5.2 of the GOM Oil and Gas SID. Supporting rationale for IPFs that were not analyzed in detail in this Programmatic EIS can also be found in Chapter 4.3.5.2 of the GOM Oil and Gas SID. New information released since the development of the GOM Oil and Gas SID and relevant to the analysis is included in the applicable chapters below.

Table 4.7-1. Impact-Producing Factors with the Potential to Impact Birds.

OCS Oil- and Gas-Related Routine Activities	OCS Oil- and Gas-Related Accidental Events	Non-OCS Oil- and Gas-Related Activities
Discharges and Wastes	Unintended Releases into the Environment	Discharges and Wastes
Noise	Response Activities	Noise
Coastal Land Use Modification	Strikes and Collisions	Coastal Land Use/Modification
Lighting and Visual Impacts	-	Lighting and Visual Impacts
Offshore Habitat Modification/ Space Use	-	Offshore Habitat Modification/ Space Use
-	-	Climate Change
-	-	Natural Processes
-	-	Other Cumulative Factors

There are several existing regulatory programs and protective measures that reduce or minimize the environmental effects of these IPFs to birds in the GOM. Regulatory requirements enforced by BOEM, BSEE, and other agencies are outlined in **Table 4.7-2** and further described in the *Gulf of Mexico OCS Regulatory Framework* technical report (BOEM 2020a). Lessees are required to perform OCS oil- and gas-related activities in accordance with regulatory requirements; therefore, this analysis factors in the mitigating effects of all applicable regulatory requirements as part of the proposed action when making impact determinations.

Table 4.7-2. Existing Regulatory Requirements and Protective Measures That Reduce the Potential Impacts of Impact-Producing Factors.

Regulatory Requirement or Protective Measure[1]	**Enforcing Agency**	**Impact-Producing Factor(s) Reduced/Avoided**	**Supporting References and Sections**
National Contingency Plan (Clean Water Act, Oil Pollution Act, National Oil and Hazardous Substances Pollution Contingency Plan)	USEPA; USCG; State; Regional; and local government	Discharges and Wastes; Unintended Releases into the Environment	40 CFR part 300, Section 311 Clean Water Act, Oil Pollution Act of 1990 (33 U.S.C. § 2701), the National Response Framework, Executive Orders 12580 and 12777, Secretarial Order 3299
Endangered Species Act	FWS	Any Impact-Producing Factor per new information through future consultations	2018 FWS BiOp
Marine Debris Research, Prevention, and Reduction Act	USEPA, USCG	Unintended Releases into Environment	33 U.S.C. § 1901, OCS Report BOEM 2020-059, 2020 NMFS 2020 BiOp (NMFS 2020b) and amended ITS (NMFS 2021a), Appendix B Protocols
CZMA	NOAA, States	Coastal Land Use/ Modification	16 U.S.C. § 1251 and 15 CFR part 930, OCS Report BOEM 2020-059 (BOEM 2020a)
CWA Section 404	USACE	Coastal Land Use/ Modification, Discharges and Wastes	33 U.S.C. § 1251, OCS Report BOEM 2020-059 (BOEM 2020a)
CWA Section 402, the National Pollutant Discharge Elimination System (NPDES) for Regions 4 and 6	USEPA	Discharges and Wastes	**Chapter 3.4.2** of this Programmatic EIS and Chapters 2.2 and 5.11 of the GOM Oil and Gas SID
MARPOL Annex V Treaty	USCG	Discharges and Wastes	Chapter 2.9.1.7 of the GOM Oil and Gas SID
Marine Plastic Pollution Research and Control Act	USCG	Unintended Releases into the Environment	33 U.S.C. § 1901, OCS Report BOEM 2020-059, 2020 NMFS BiOp (NMFS 2020b) and amended ITS (NMFS 2021a), Appendix B Protocols
BSEE Pollution Prevention (30 CFR § 250.300)	BSEE	Discharges and Wastes	30 CFR § 250.300 (BSEE), Chapter 5.1.3 of the GOM Oil and Gas SID

Regulatory Requirement or Protective Measure[1]	Enforcing Agency	Impact-Producing Factor(s) Reduced/Avoided	Supporting References and Sections
Visual Flight Rules Near Noise-Sensitive Areas	FAA	Strikes and Collisions	FAA: AC No: 91-36D (Kaulia 2004)

[1] Refer to Chapter 6 of the GOM Oil and Gas SID for conditions of approval commonly applied at the post-lease stage.

4.7.2.1 OCS Oil- and Gas-Related Impact-Producing Factors from Routine Activities

Discharges and Wastes: Birds in the GOM can be exposed to operational discharges and wastes that include produced waters, drilling muds and cuttings, and routine air emissions from these activities: vessel transits and operations; support helicopter use; pipelaying operations; flaring and venting; decommissioning of facilities and pipelines; exploration and development activities; and production activities. Oil sheens from produced waters may result in mortality if sheen contacts the birds' feathers, where it can compromise the structure, leading to starvation and hypothermia (Fraser et al. 2006; Wiese and Ryan 2003). Discharges of drilling muds rapidly settle to the seafloor around the drill site, where there is potential to lead to temporary loss of benthic foraging habitat for deep-diving birds (Neff 2005). The release of routine OCS oil- and gas-related discharges and wastes are localized and temporary, and discharges are expected to disperse quickly. These routine OCS oil- and gas-related releases may result in small and temporary disturbances, which have the potential to affect individuals or small groups of birds, if present; however, population-level effects are not expected. Routine OCS oil- and gas-related discharges and wastes are regulated by BSEE, USEPA, and USCG, who protect against degradation of the marine environment. A description of these rules and regulations is provided in **Chapter 3.4.4**. Lessees are required to perform OCS oil- and gas-related activities in accordance with regulatory requirements that minimize or avoid impacts to foraging habitat from discharges (e.g., ballast), trash, and other waste (e.g., NPDES, 30 CFR § 250.300, and MARPOL 73/78; refer to **Table 4.7-2**). For more information on the impacts of OCS oil- and gas-related discharges and wastes to birds, refer to Chapter 4.3.5.2.2 of the GOM Oil and Gas SID and Chapter 4.8.2 of BOEM's Biological Environmental Background Report (BOEM 2021b).

Noise: Vessel and equipment noise make up most of the sounds produced by BOEM-regulated activities, including vessel and aircraft traffic, surveys, drilling, trenching, production, offshore and onshore construction, and explosive platform decommissioning and removal noise. Anticipated impacts on birds exposed to these sound sources could include localized disturbance, temporary displacement, and masking of bird vocalization and communication. Vessels and helicopters could cause disturbance to breeding birds and possibly decrease nesting success if the traffic occurs too close to a breeding colony. If disturbance were to occur, birds have shown the ability to return to pre-disturbance behavior within 5 minutes (Komenda-Zehnder et al. 2003). For more information on the impacts of OCS oil- and gas-related noise to birds, refer to Chapter 4.3.5.2.2 of the GOM Oil and Gas SID and Chapter 4.8.1 of BOEM's Biological Environmental Background Report (BOEM 2021b).

Coastal Land Use/Modification: Coastal land disturbance could temporarily or permanently reduce the availability of bird nesting and feeding habitats. As discussed in **Chapter 4.3**, new construction or expansion of onshore facilities, temporary or permanent roads, and pipeline landfalls can alter coastal and estuarine habitats. These activities could potentially impact bird species that rely on these habitats for nesting and feeding, leading to displacement. Construction-related disturbance could increase the temporary suspension of sediments in the coastal water column, temporally decreasing the local water quality. Decreased water quality and increased turbidity could compromise the quality of the prey and the birds' ability to locate prey within the construction area. Additionally, vessel traffic could contribute to shoreline erosion, leading to possible habitat degradation and localized, increased temporary turbidity. State and Federal permitting agencies discourage the placement and expansion of facilities in wetlands and mitigate impacts (e.g., Clean Water Act, USACE's 404 permit, CZMA, and State permitting programs; **Table 4.7-2**), and lessees are required to perform OCS oil- and gas-related activities in accordance with regulatory requirements that minimize or avoid impacts.

Lighting and Visual Impacts: Artificial lighting (e.g., structure lighting) could impact birds by attracting them to offshore infrastructure and disorienting them on their migration pathways. Attraction to artificial lighting could impose energetic costs to individual birds, as well as collision risk with structures, which could result in injury or mortality (Longcore and Rich 2004). Alternatively, artificial lighting can create foraging opportunities for birds. For example, gulls rest and forage at night on the sea surface under the platform lights, which are thought to attract their prey to the surface (Burke et al. 2012).

Birds can be attracted to flares used on offshore platforms (Montevecchi 2006; Poot et al. 2008; Ronconi et al. 2015; Russell 2005). Attraction has been documented during a nocturnal gas-flaring event that had an installed anti-collision lighting system (Day et al. 2005; 2015). Attracted birds also displayed non-directional flight behaviors, suggesting that the birds were circling the gas flare. The response to the gas-flaring event varied among species, with long-tailed ducks being the most represented taxa among those attracted (Day et al. 2015). Several early studies on the effects of gas flares on birds reported no mortality events or injury to birds (Hope Jones 1980; Sage 1979; Wallis 1981). However, one study suggests that incinerations from colliding with gas flares may be killing more birds than previously thought (Bjorge 1987). Bourne (1979) estimated that annual mortality rates from interactions with gas flares are a few hundred birds per platform. For more information on the impacts of OCS oil- and gas-related lighting to birds, refer to Chapter 4.8.7 of BOEM's Biological Environmental Background Report (BOEM 2021b).

Offshore Habitat Modification/Space Use: The placement of oil and gas platforms and associated offshore equipment has the potential to affect birds found in the GOM. Offshore oil and gas platforms create a structural presence in the GOM that otherwise would not exist or serve as habitats for birds, resulting in potentially complex direct and indirect effects on birds. Infrastructure emplacement could cause temporary and long-term disturbance via avoidance or attraction (Baird 1990; Montevecchi 2006; Russell 2005; Tasker et al. 1986). Platforms can serve as artificial reefs supporting biodiverse communities, including bird prey. Many species opportunistically utilize these spaces for roosting and resting sites (Burke et al. 2012). For more information on the impacts of OCS oil- and gas-related offshore habitat modification to birds, refer to Chapter 4.3.5.2.2 of the GOM Oil and Gas SID and Chapter 4.8.5 of BOEM's Biological Environmental Background Report (BOEM 2021b).

4.7.2.2 OCS Oil- and Gas-Related Impact-Producing Factors from Accidental Events

Unintended Releases into the Environment: The effects of unintended releases (e.g., oil or chemicals) on birds depend on many variables, including spill location, spill size, spill composition, weather events, oceanographic conditions, and time of year, as well as the behavior and physiology of the birds (Castege et al. 2007; Wiese and Jones 2001). Repeated exposure to spills could also be a factor in determining the level of impact on birds. Direct impacts to birds that encounter accidentally spilled oil could include tissue and organ damage from ingested or inhaled oil as well as interference with food detection, predator avoidance, homing of migratory species, disease resistance, growth rates, reproduction, and respiration. Birds could ingest and inhale spilled oil while feeding on oiled benthic, planktonic, or pelagic prey; grooming (i.e., preening) oiled plumage; or drinking hydrocarbons in water. The ingestion or inhalation to the extent of toxic oiling could cause bird mortality. Through the National Contingency Plan (40 CFR part 300) and the Federal laws that underpin this regulation, there are mitigations and plans in place at the Federal, State, and local levels (e.g., from USCG, BSEE, States, NMFS, FWS, and NPS) that could decrease impacts to birds (ESA-listed or migratory) if present from oil spills (refer to **Table 4.7-2**). Lessees are required to perform OCS oil- and gas-related activities in accordance with regulatory requirements.

Routine OCS oil- and gas-related activities, such as vessel operations, are required to be proactive against the loss of solid waste items by developing waste management plans, posting informational placards, manifesting trash sent to shore, and using special precautions such as covering outside trash bins to prevent accidental loss of solid waste. However, it is still possible to have accidental release of trash and debris into the marine environment, which has documented impacts to birds. Birds could be impacted by plastic by mistakenly ingesting pieces when foraging or by trophic transfer (Carrillo et al. 2023; Grace et al. 2022; Moore 2008). Once ingested, these plastics are largely non-digestible and can cause blockages, internal damage, and a false sense of satiety (Grace et al. 2022; Wright et al. 2013). Additionally, chemicals can leach from plastics following ingestion, which creates an ecotoxicological concern (Tanaka et al. 2013; Tanaka et al. 2019). To date, there is a lack of data on distribution of plastic, accumulation in biota, and potential vulnerable species in the GOM. Therefore, it is difficult to draw conclusions as to the extent of the problem and its impacts on bird populations. There are mitigating measures that can reduce the potential for trash and debris in the marine environment. The BSEE, USCG, and USEPA's regulations, and BOEM's guidance minimize unintended releases of trash and debris by oil and gas operators. The prohibition of discharging materials into the marine environment is outlined in the Marine Plastic Pollution Research and Control Act, MARPOL Annex V, and the Marine Debris Research, Prevention and Reduction Act (refer to **Table 4.7-2**). Lessees are required to perform OCS oil- and gas-related activities in accordance with regulatory requirements. For more information on the impacts of OCS oil- and gas-related unintentional releases into the environment to birds, refer to Chapter 4.3.5.2.3 of the GOM Oil and Gas SID and Chapters 4.9.1.1 and 4.9.1.3 of BOEM's Biological Environmental Background Report (BOEM 2021b).

Response Activities: The effectiveness of the response, containment, and cleanup activities (offshore and shoreline) could influence the degree of impact that post-oil or chemical spills have on birds. Depending on the volume and spatial extent of a spill, the subsequent cleanup and response efforts in coastal habitats and beaches can be a large-scale activity. Oil-spill response and cleanup activities could affect birds' prey, their coastal habitats, and their reproductive abilities. Birds may experience fewer foraging opportunities and lower quality food availability. Birds could also face habitat loss of foraging, nesting, breeding, wintering, and roosting grounds. Chemical dispersants have been shown to be toxic to birds and if used may lead to decreases in hatching success (Finch et al. 2012; Wooten et al. 2012). For more information on the impacts of OCS oil- and gas-related response activities to birds, refer to Chapter 4.3.5.2.3 of the GOM Oil and Gas SID and Chapter 4.9.1.2 of BOEM's Biological Environmental Background Report (BOEM 2021b).

Strikes and Collisions: Some birds follow ships as a foraging strategy, though this is more common with commercial and recreational fishing vessels. In the open ocean, vessel transits and operations can attract birds from long distances. Low-flying aircraft (e.g., helicopters) could disturb birds, including those resting or foraging on the water surface or those in flight. Birds can respond to flying aircraft by flushing into flight or rapidly changing their flight speed or direction. These behavioral responses to the aircraft could result in accidental strikes. However, the potential for bird collisions with aircraft decreases at speeds greater than 80 kn (93 mph) (Rotocraft Bird Strike Working Group 2019). Most helicopters fly at an average speed of 140 kn (161 mph). Additionally, the Federal Aviation Administration recommends that aircraft fly at least 2,000 ft (610 m) above the ground when passing over noise sensitive areas (i.e., national parks, national wildlife refuges, waterfowl protection areas, and wilderness areas), which decreases the chances of behavioral responses and subsequent collisions from the higher density of birds in those areas (Kaulia 2004); refer to **Table 4.7-2**). Lessees are required to perform OCS oil- and gas-related activities in accordance with regulatory requirements. For more information on the impacts of OCS oil- and gas-related strikes and collisions to birds, refer to Chapter 4.3.5.2.3 of the GOM Oil and Gas SID and Chapter 4.9.1.4 of BOEM's Biological Environmental Background Report (BOEM 2021b).

4.7.2.3 Alternatives Analysis

Alternative A – No Action (Cancellation of a Single Proposed OCS Oil and Gas Lease Sale)

Under Alternative A, a proposed lease sale would not occur, so there would be no new routine activities or accidental events resulting from the proposed action. Therefore, no direct or indirect impacts to birds would occur as a result of the proposed action (i.e., a single proposed OCS oil and gas lease sale) and the impacts would be **none**. However, there are ongoing OCS oil- and gas-related activities (shown in **Table 3.3-2**) and other non-OCS oil- and gas-related activities that contribute to the baseline environment (summarized in **Chapter 4.0.1** of this Programmatic EIS and described in detail in Chapter 3 of the GOM Oil and Gas SID) that could affect birds that would still occur. Ongoing activities associated with previous OCS oil and gas lease sales (**Table 3.3-2**) could still have potential direct and/or indirect impacts to birds through discharges and wastes, noise, coastal land use/modification, light and visual impacts, offshore habitat modification/space use, unintended releases into the environment, response activities, and strikes and collisions. The potential impacts are summarized above in **Chapter 4.7.2.2** and in greater detail in Chapter 4.4.3 of the GOM Oil and Gas SID and evaluated as part of the cumulative analysis in **Chapter 4.17.8**.

Comparison of Impacts under Alternatives B, C, and D

A proposed regionwide OCS oil and gas lease sale under Alternatives B through D, and the resulting proposed OCS oil- and gas-related development on any subsequent leases from the lease sale, would result in discharges and wastes, noise, coastal land use/modification, lighting and visual impacts, offshore habitat modification/space use, unintended releases into the environment, response activities, and strikes and collisions that could potentially impact birds. Under all three alternatives, the level of activities in **Table 3.3-2** are projected to remain the same, only the geographic area changes.

Alternative B represents the largest geographic area under consideration for a proposed regionwide lease sale. Alternatives C and D represent geographical constraints on available acreage for leasing, which could change the spatial distribution of the scenario activities, but not their overall activity levels. Therefore, this alternative analysis is focused on the potential environmental impacts of a proposed regionwide lease sale (Alternative B) and then considers if these potential impacts could be reduced by the geographic constraint under each alternative considered (Alternatives C and D).

Table 4.7-3 shows the impact determinations for each IPF that affects birds for each alternative analyzed. The impacts of Alternative A are not shown in the **Table 4.7-3** because the impacts are **none** for all IPFs.

Table 4.7-3. Impact Determinations for Routine and Accidental Impacts to Birds for Alternatives B-D.

Impact-Producing Factor	BOEM's Protective Measure[1]	Alternative B	Alternative C	Alternative D
Discharges and Wastes	N/A	**Negligible** to **Minor**	**None** in excluded areas; **Negligible** to **Minor** in leased areas only	**None** in excluded areas; **Negligible** to **Minor** in leased areas only
Noise	N/A	**Negligible** to **Minor**	**None** in excluded areas; **Negligible** to **Minor** in leased areas only	**None** in excluded areas; **Negligible** to **Minor** in leased areas only
Coastal Land Use/ Modification	N/A	**Negligible** to **Minor**	**None** in excluded areas; **Negligible** to **Minor** in leased areas only	**None** in excluded areas; **Negligible** to **Minor** in leased areas only
Lighting and Visual Impacts	N/A	**Negligible** to **Minor**	**None** in excluded areas; **Negligible** to **Minor** in leased areas only	**None** in excluded areas; **Negligible** to **Minor** in leased areas only

Impact-Producing Factor	BOEM's Protective Measure[1]	Alternative B	Alternative C	Alternative D
Offshore Habitat Modification/ Space Use	N/A	**Negligible** to **Minor**	**None** in excluded areas; **Negligible** to **Minor** in leased areas only	**None** in excluded areas; **Negligible** to **Minor** in leased areas only
Unintended Releases into the Environment (marine debris)	N/A	**Negligible**	**Negligible**	**Negligible**
Unintended Releases into the Environment (oil spills)	N/A	**Negligible** to **Moderate**	**Negligible** to **Moderate**	**Negligible** to **Moderate**
Response Activities	N/A	**Negligible** to **Minor**	**Negligible** to **Minor**	**Negligible** to **Minor**
Strikes and Collisions	N/A	**Negligible** to **Minor**	**Negligible** to **Minor**	**Negligible** to **Minor**

Note: Alternative A is not shown in the table because the impacts from all impact-producing factors is **none**.
[1] No programmatic protective measures for application at the OCS lease sale stage are being contemplated in this Programmatic EIS. All BOEM protective measures for birds would be considered at the site-specific stage.

Alternative B – Regionwide OCS Lease Sale

Alternative B considers a proposed regionwide OCS lease sale area. Within this geographic area, impacts may affect a variety of birds, including ESA-listed species such as the Mississippi sandhill crane, piping plover, rufa red knot, whooping crane, wood stork, eastern black rail, and the black-capped petrel. While estuarine and coastal areas are not included within the proposed lease sale area, impacts from the proposed action may extend to coastal areas due to activities such as vessel transit and onshore support structure emplacement. These activities are unlikely to impact critical habitat locations since the use of existing ports and/or structures would largely confine anticipated impacts to previously disturbed areas.

Discharges and Wastes: Discharges and wastes can occur from any routine OCS oil- and gas-related activity except for helicopter operations (**Table 3.3-4**). Within this geographic area, impacts from discharges and wastes could affect bird foraging habitat and feather structure. Given the level of these activities described in **Table 3.3-2** for a single proposed OCS oil and gas lease sale to occur over a 40-year lifespan, impacts are expected to be **negligible** to **minor** because discharges and wastes are anticipated to be highly localized and dissipate quickly. In addition, lessees are required to perform OCS oil- and gas-related activities in accordance with regulatory requirements that minimize or avoid impacts to foraging habitat from discharges (e.g., ballast), trash, and other waste (e.g., NPDES, 30 CFR § 250.300, and MARPOL 73/78; refer to **Table 4.7-2**). Considering the distribution of bird populations throughout the GOM, any effects are not expected to reach a level that would have population-level effects to bird communities or effects on bird habitat function or use.

Noise: Within this geographic area, impacts from noise could affect birds by causing localized disturbances, temporary displacement, and masking of vocalizations and communication. Effects from anthropogenic-derived noise would be species- and life stage-specific and depend on exposure levels. Given the level of routine OCS oil- and gas-related activities described in **Table 3.3-2** for a single proposed OCS oil and gas lease sale that could lead to elevated noise levels (e.g., G&G surveys, structure installation, pipeline installation, structure removal with explosives, vessel trips, and helicopter operations), these impacts are expected to be **negligible** to **minor** because noise would be localized for a short amount of time, potentially resulting in short-term impacts to individuals or small groups of birds.

Coastal Land Use/Modification: Within this geographic area, impacts from coastal land use/modification could affect bird species that rely on these habitats for nesting and feeding, leading to displacement. The impacts are expected to be **negligible** to **minor**, as onshore industrial infrastructure is already largely in place (including support and helicopter bases) and any new onshore construction would likely occur in already industrialized locations. However, the relative amount of added vessel traffic from service vessels and pipeline installation (**Table 3.3-2**) could result in adverse localized impacts to bird nesting and foraging habitat quality and extent from erosion if it were to occur in an area of concern. In addition, State and Federal permitting agencies discourage the placement and expansion of facilities in wetlands and mitigate impacts (e.g., Clean Water Act, USACE's 404 permit, CZMA, and State permitting programs; refer to **Table 4.7-2**), and lessees are required to perform OCS oil- and gas-related activities in accordance with regulatory requirements that minimize or avoid impacts.

Lighting and Visual Impacts: Within this geographic area, impacts from lighting could affect birds by disorienting them on their migration pathways and increasing collision risk. Given the level of routine OCS oil- and gas-related activities described in **Table 3.3-2** for a single proposed OCS oil and gas lease sale that could lead to artificial lighting (e.g., platforms; vessels), any impacts are expected to be **negligible** to **minor** because any effects (e.g., disorientation, displacement, and/or potential collisions) are expected to vary by location and occur within areas already used by the OCS oil and gas industry. In addition, the projected number of installed production structures is less than the number that is projected to be removed (**Table 3.3-2**), which is expected to result in a net reduction in the overall amount of artificial lighting on the OCS related to oil and gas activities. Any effects are not anticipated to reach a level that would have population-level effects to birds.

Offshore Habitat Modification/Space Use: Within this geographic area, impacts from offshore habitat modification/space use could affect birds within proximity to the emplaced structures on the OCS (e.g., platforms). Offshore habitat modification/space use has the potential to create habitat that would otherwise not exist and alter normal migration patterns and predator/prey interactions. The impacts from offshore habitat modification/space use are **negligible** to **minor** because any effects are expected to vary by location and occur within areas already used by the OCS oil and gas industry. Further, it is projected that the number of installed production structures would be less than the number that are projected to be removed (**Table 3.3-2**). Any effects are not anticipated to reach a level that would have population-level effects to bird communities or significantly affect bird habitat function or use.

Unintended Releases into the Environment: Within this geographic area, impacts from unintended releases into the environment could affect birds through exposure to oil spills, causing injury, reduced mobility, increased susceptibility to predation, decreased feeding ability, fitness consequences, increased vulnerability to disease, decreased health, decreased reproductive fitness, and/or death. Non-oil spills (e.g., chemical spills, synthetic-based fluid spills) would likely be relatively infrequent based on the occurrences of these accidental spills calculated over the past decade (**Tables 3.5-2 and 3.5-3**). Based on the number and volume of accidental oil spills estimated for a single OCS oil and gas lease sale (Ji and Schiff 2023)), negative impacts to birds could range from undetectable for small spills to notable, direct impacts for larger spills. Therefore, the impacts from unintended releases are **negligible** to **moderate** depending on the type, frequency, duration, and geographic extent of the release. Through the National Contingency Plan (40 CFR part 300) and the Federal laws that underpin this regulation, there are mitigations and plans in place at the Federal, State, and local levels (e.g., from USCG, BSEE, States, NMFS, FWS, and NPS) that decrease impacts to birds from oil spills (**Table 4.7-2**). Lessees are required to perform OCS oil- and gas-related activities in accordance with regulatory requirements. Impacts from trash and marine debris tied to a single OCS oil and gas lease sale would be largely undetectable and **negligible**, especially given the regulations in place to reduce and eliminate marine trash and debris, and lessees are required to perform OCS oil- and gas-related activities in accordance with regulatory requirements (**Table 4.7-2**).

Response Activities: Within this geographic area, impacts from response activities could affect birds in the vicinity of spill response activities. These response activities (e.g., increased vessel traffic, use of dispersants, and remediation activities) could result in impacts such as decreased reproductive success, fitness, and displacement from nesting or foregoing locations. Given that oil spills and subsequent response activities would be temporary and/or localized to the habitat and species common to the area, and the spill response plans and safety protocols (e.g., National Contingency Plans) in which lessees are required to perform OCS oil- and gas-related activities in accordance (**Table 4.7-2**), any impacts are expected to be **negligible** to **minor** depending on the type of response, and the frequency, duration, and geographic extent of the event.

Strikes and Collisions: Within this geographic area, impacts from strikes and collisions could affect birds attracted to vessels to forage for prey. Additionally, low-flying aircraft (e.g., helicopters) could disturb birds and result in accidental strikes, but avoidance aerial strategies are likely in-place to avoid such interactions. The potential for bird collisions with aircraft decreases at speeds greater than 80 kn (93 mph) (Efroymson et al. 2000; Rotocraft Bird Strike Working Group 2019), and most helicopters fly at an average speed of 140 kn (161 mph). Some impacts to birds may be reduced through the Federal Aviation Administration recommendations for aircraft height above sensitive areas (Kaulia 2004) (refer to **Table 4.7-2**). Lessees are required to perform any tactical measures in accordance with other regulatory requirements when conducting OCS oil- and gas-related activities. Therefore, the reasonably foreseeable impacts to birds from strikes and collisions are expected to be **negligible** to **minor**, especially given the flight speed recommendations suggested by the FAA.

Therefore, based on the description of the IPFs above and the scenario projections for a single proposed OCS oil and gas lease sale provided in **Chapter 3**, the overall impacts from IPFs associated with Alternative B on birds are **negligible** to **moderate**. There are no existing BOEM mitigations for birds that would potentially diminish these impacts; however, as discussed above, lessees are required to perform OCS oil- and gas-related activities in accordance with regulatory requirements, and those requirements, which can reduce impacts to birds, are considered in this impact analysis.

Alternative C – Inflation Reduction Act Targeted OCS Lease Sale Area

Alternative C represents a geographical constraint on available acreage for leasing, which would cause a change in the spatial distribution of activities compared to Alternative B, but not their overall activity levels. Most impacts to birds from routine OCS oil- and gas-related activities are not expected to occur in areas removed from potential leasing under Alternative C because, as discussed under Alternative B, areas of impacts from routine OCS oil- and gas-related activities occur within limited areas surrounding the activity. Routine impacts would be limited to the areas leased under this alternative. The impacts from accidental events would be the same as described for Alternative B, including vessel and aircraft strikes though unlikely, which could occur in excluded areas because vessels and aircraft could still transit the excluded areas. This potential spatial redistribution of activity does not affect impact levels to birds because of their abundance and basin-wide distribution across the northern GOM. The areas that are part of the geographical constraint (i.e., approximately 28.7 million acres removed from potential leasing) do not contain unique bird habitats or communities that differ from the remaining areas, leaving impact determinations unchanged for Alternative C. In addition, the IPFs from routine activities are not changed from Alternative B.

Therefore, based on the description of the IPFs above and the scenario projections for a single proposed OCS oil and gas lease sale provided in **Chapter 3**, the overall impacts from IPFs associated with Alternatives C on birds would be **negligible** to **moderate** in leased areas given the distribution of birds across the entire northern GOM. Any effects are expected to be localized and are not anticipated to reach a level that would have population-level effects to birds or detectable effects on GOM bird habitat function or use. In addition, lessees are required to perform OCS oil- and gas-related activities in accordance with regulatory requirements (**Table 4.7-2**), which can help reduce impacts to birds.

Alternative D – Targeted OCS Lease Sale Area with Additional Exclusions

Alternative D represents a geographical constraint on available acreage for leasing, which would cause a change in the spatial distribution of activities compared to Alternative B or C, but not their overall activity levels. Most impacts to birds from routine OCS oil- and gas-related activities are not expected to occur in areas removed from potential leasing under Alternative D because, as discussed under Alternative B, areas of impacts from routine OCS oil- and gas-related activities occur within limited areas surrounding the activity. Routine impacts would be limited to the areas leased under this alternative. The impacts from accidental events would be the same as described for Alternative B, including vessel and aircraft strikes though unlikely, which could occur in excluded areas because vessels and aircraft could still transit the excluded areas. This potential spatial redistribution of activity does not affect impact levels to birds because of their wide distribution across the northern GOM. The areas that are part of the geographical constraint (i.e., approximately 45.7 million acres removed from potential leasing) do not contain unique birds that differ from the remaining areas, leaving impact determinations unchanged for Alternative D. In addition, the IPFs from routine activities are unchanged from Alternative B.

Therefore, based on the description of the IPFs above and the scenario projections for a single proposed OCS oil and gas lease sale provided in **Chapter 3**, the overall impacts from IPFs associated with Alternative D to birds would be **negligible** to **moderate** in leased areas given the distribution of birds across the entire northern GOM. Any effects are expected to be localized and are not anticipated to reach a level that would have population-level effects to birds or detectable effects on GOM bird habitat function or use. In addition, lessees are required to perform OCS oil- and gas-related activities in accordance with regulatory requirements (**Table 4.7-2**), which can help reduce impacts to birds.

4.7.3 Incomplete or Unavailable Information

BOEM has identified incomplete or unavailable information that may be relevant to reasonably foreseeable impacts on birds or ESA-listed birds. Few studies have evaluated the impacts of artificial lighting along the coast on birds. Climate change and ocean acidification are also expected to impact marine and coastal birds through habitat and food web alterations; however, the extent of these impacts are not known. Additionally, the distribution and impacts of marine debris produced from land versus offshore on marine birds is largely understudied in the GOM. BOEM has used the best available scientific information to date and reasonably accepted scientific methodologies to extrapolate from existing information. Therefore, the incomplete or unavailable information, while relevant, is not necessary to make a reasoned choice among alternatives. Further, this information would not likely change the impact conclusions reached in this analysis.

4.8 MARINE MAMMALS

The GOM's marine mammals include members of the taxonomic order Cetacea, including suborders Mysticeti (i.e., baleen whales) and Odontoceti (i.e., toothed whales), as well as the order Sirenia (i.e., manatee). Twenty-one species of cetaceans and one species of Sirenia regularly occur in the GOM and are identified in the NMFS Stock Assessment Reports (Hayes et al. 2021; 2022). Dolphins in Barataria Basin in Louisiana were confirmed to be genetically differentiated from those in adjacent coastal waters (Speakman et al. 2022). Further, genetically distinct stocks of bottlenose dolphins were identified along the Texas coast, with a high degree of genetic differentiation among adjacent stocks (Garrison et al. 2024). The sperm whale and the Rice’s whale (formerly GOM Bryde’s whale) regularly occur in the GOM and are listed as endangered under the ESA. The West Indian manatee, in which the Florida manatee is a subspecies, is listed as threatened under the ESA and has designated critical habitat in northeastern Florida (41 FR 41914); as of October 2023, there is a petition to reclassify the West Indian manatee as endangered (88 FR 70634). The Florida manatee has been documented all along the Gulf Coast in nearshore waters, typically less than 4 m (13 ft) deep and within 1,000 m (328 ft) of the shore (Slone et al. 2022). The MMPA protects all marine mammals, regardless of ESA status. The NMFS is charged with protecting all cetaceans, while manatees are under the jurisdiction of the FWS.

4.8.1 Affected Environment

Most marine mammal distributions widely vary across the northern GOM with little known about each species' breeding and calving grounds, as well as any general patterns of movement. Several species (e.g., Rice's whale, sperm whale, and bottlenose dolphin) have presumed yearround resident populations in the GOM (Harrison et al. 2023). The distribution and abundance of cetaceans within the northern GOM is strongly influenced by various mesoscale oceanographic circulation patterns and other factors influencing feeding behaviors. Very little is known generally about other factors that may influence marine mammal distribution in the northern GOM. Multiple distinct hotspots of cetacean strandings in the north-central GOM (e.g., Alabama) have been identified, with bottlenose dolphins being the most reported (Russell et al. 2022). These hotspots may be areas of increased documented strandings due to bathymetry, geography, human population density, or sources of mortality such as increased fisheries presence.

An evolutionarily divergent lineage of baleen whale (i.e., Rice’s whale) was identified based on genetic data (86 FR 47022 ; Rosel et al. 2021). The majority of Rice’s whale detections are limited to the northeastern GOM along the continental shelf between roughly 100- and 400-m (328- and 1,312-ft) depth within a Core Distribution Area (NMFS 2023h). However, there have been acoustic detections of Rice’s whale calls in the northwestern and north-central GOM with no observed seasonality (Soldevilla et al. 2022; 2024). There may be fewer or more sporadically spaced Rice’s whales in the northwestern GOM compared to the northeastern GOM (Soldevilla et al. 2022), though regular occurrence of Rice’s whale calls were detected at two northwestern GOM sites (Soldevilla et al. 2024). During vessel surveys conducted from 2003 to 2019, Rice’s whales were primarily observed in the northeastern GOM near the 220-m (722-ft) isobath (Rappucci et al. 2023). Rice’s whales are likely selective predators, mostly foraging on high-energy content prey, particularly *Ariomma bondi*, a schooling fish (Kiszka et al. 2023). Rice’s whales appear to forage during the day near the seafloor (150- to 250-m [492- to 820-ft] water depth) on the upper continental slope of their northeastern GOM habitat where *A. bondi* also appears to primarily occur. During 2017 and 2018 surveys, sperm whale sightings contrasted and primarily occurred in the central and western northern GOM and were less frequent in the northeastern GOM (Rappucci et al. 2023). Rice's whale critical habitat is currently proposed by NMFS (88 FR 47453) in the northern GOM from the 100 m (328 ft) to the 400-m (1,312-ft) isobath (88 FR 47453). On October 27, 2023, NOAA Fisheries denied a petition to establish vessel-related mitigating measures aimed at protecting Rice’s whales in the GOM, citing the need to conduct much-needed research to inform any future regulatory decisions and to prioritize developing a recovery plan for the species, consistent with Section 4(f) of the ESA (NMFS 2023g).

More information on the general descriptions of marine mammals can be found in the 2020 NMFS BiOp, as amended (NMFS 2020b); Chapter 3.7 of BOEM’s Biological Environmental Background Report (BOEM 2021b); and Chapter 4.3.6.1 of the GOM Oil and Gas SID.

4.8.2 Environmental Consequences

Marine mammals in the GOM are affected by existing environmental conditions, natural processes and phenomena, and human-induced factors. Chapter 4.3.6.1 of the GOM Oil and Gas

SID describes the programmatic concerns influencing marine mammals, primarily climate change. There are also several OCS oil- and gas-related activities and non-OCS oil- and gas-related activities that have the potential to impact marine mammals (**Table 4.8-1**). BOEM conducted an initial screening of IPFs in the GOM Oil and Gas SID and determined that noise, offshore habitat modification/space use, bottom disturbance, unintended releases into the environment, response activities, and strikes and collisions could potentially impact marine mammals. These IPFs and their potential to affect marine mammals are discussed below and in greater detail in Chapter 4.3.6.2 of the GOM Oil and Gas SID. Offshore habitat modification/space use and bottom disturbance were initially scoped out in the GOM Oil and Gas SID but have since been determined to impact marine mammals and is included in this analysis. Supporting rationale for IPFs that were not analyzed in detail in this Programmatic EIS can be found in Chapter 4.3.6.2 of the GOM Oil and Gas SID. New information released since development of the GOM Oil and Gas SID and relevant to the analysis are included in the applicable chapters below.

Table 4.8-1. Impact-Producing Factors with the Potential to Impact Marine Mammals.

OCS Oil- and Gas-Related Routine Activities	OCS Oil- and Gas-Related Accidental Events	Non-OCS Oil- and Gas-Related Activities
Noise	Unintended Releases into the Environment	Noise
Offshore Habitat Modification/ Space Use	Response Activities	Discharges and Wastes
Bottom Disturbance	Strikes and Collisions	Coastal Land Use/Modification
-	-	Offshore Habitat Modification/ Space Use
-	-	Bottom Disturbance
-	-	Strikes and Collisions
-	-	Climate Change

There are several existing regulatory programs and protective measures that reduce or minimize the environmental effects of these IPFs to marine mammals in the GOM. Regulatory requirements enforced by BOEM, BSEE, and other agencies are outlined in **Table 4.8-2** and further described in the *Gulf of Mexico OCS Regulatory Framework* technical report (BOEM 2020a). The protective measures and regulatory requirements listed in **Table 4.8-2** reduce impacts to marine mammals by reducing noise exposure; requiring protections in coastal areas; requiring avoidance distances from sensitive benthos; requiring precautions for lines in the water; requiring safety measures for accidental oil spills and spills response; requiring protected species observers; reducing or eliminating accidental trash and debris; and preventing or reducing, and reporting vessel strikes.

Lessees are required to perform OCS oil- and gas-related activities in accordance with all regulatory requirements, including existing and future consultation requirements under the ESA, MMPA, and other statutes. Therefore, this analysis factors in the mitigating effects of all applicable regulatory requirements as part of the proposed action when making impact determinations.

Compliance with existing and future consultation requirements[9] – by BOEM as well as individual operators and lessees, as required – may result in additional mitigating measures or updates to the existing measures described throughout this chapter. Through adaptive management, BOEM would incorporate new or updated measures resulting from ongoing or future consultations into post-lease plan reviews and authorizations, as appropriate (Chapter 6 of the GOM Oil and Gas SID).

Table 4.8-2. Existing Regulatory Requirements and Protective Measures That Reduce the Potential Impacts of Impact-Producing Factors.

Regulatory Requirement or Protective Measure[1]	Enforcing Agency	Impact-Producing Factor(s) Reduced/Avoided	Supporting References and Sections
Protected Species Stipulation	BOEM	Offshore Habitat Modification/Space Use, Unintended Releases into the Environment, Noise, Strikes and Collisions	Chapters 6 and 7.5 of the GOM Oil and Gas SID
OCSLA	BOEM, BSEE	Offshore Habitat Modification/Space Use	43 U.S.C. § 1331; OCS Report BOEM 2020-059 (BOEM 2020a)
CZMA	NOAA, States	Coastal Land Use/ Modification	16 U.S.C. § 1251 and 15 CFR part 930; OCS Report BOEM 2020-059 (BOEM 2020a)
ESA	FWS, NOAA, NMFS, BOEM, BSEE	Offshore Habitat Modification/Space Use, Noise, Unintended Releases into the Environment, Strikes and Collisions	2018 FWS BiOp (no Terms and Conditions required for the Florida manatee); OCS Report BOEM 2020-059; 2020 NMFS BiOp (NMFS 2020b) and amended ITS (NMFS 2021a) Appendix A, Appendix B, Appendix C, Appendix I, Moon Pool Monitoring COA, Slack-line Precautions COA, Reporting Requirements COA; Notification of Intention to Transit Rice's Whale Area COA; Pile Driving Monitoring and Reporting Requirements COA
National Marine Sanctuaries Act – Flower Garden Banks National Marine Sanctuary, including NMSA 304(d)	NOAA, ONMS	Noise, Bottom Disturbance	15 CFR part 922 subpart L; 16 U.S.C. § 1434(d)

[9] For example, a plan approval would be conditioned upon compliance with the applicable Reasonable and Prudent Measures and Terms and Conditions of the most recent Biological Opinion issued by the NMFS at the time of the site-specific review (**Appendix A.3**). This includes adaptively managing the mitigation, monitoring, and reporting requirements (2020 BiOp Appendices, as amended, and/or COAs) imposed by the Bureaus on plans and permits, and as coordinated with NMFS and industry. Any future BiOp amendments or COAs shall be a requirement and binding on subsequent BOEM authorizations.

Regulatory Requirement or Protective Measure[1]	Enforcing Agency	Impact-Producing Factor(s) Reduced/Avoided	Supporting References and Sections
CWA Section 404	USACE	Coastal Land Use/ Modification, Discharges and Wastes	33 U.S.C. § 1251, OCS Report BOEM 2020-059 (BOEM 2020a)
Marine Plastic Pollution Research and Control Act	USCG	Unintended Releases into the Environment (accidental marine debris)	33 U.S.C. § 1901; OCS Report BOEM 2020-059; 2020 NMFS BiOp (NMFS 2020b) and amended ITS (NMFS 2021a), Appendix B
National Contingency Plan (CWA, Oil Pollution Act, National Oil and Hazardous Substances Pollution Contingency Plan)	USCG; USEPA; State, regional, and local governments	Unintended Releases into the Environment (accidental oil spill and spill response)	40 CFR part 300, Section 311 of the Clean Water Act; Oil Pollution Act of 1990 (33 U.S.C. § 2701), National Response Framework, Executive Orders 12580 and 12777, Secretarial Order 3299
Marine Debris Research, Prevention, and Reduction Act	USEPA, USCG	Unintended Releases into the Environment (accidental marine debris)	33 U.S.C. § 1901; OCS Report BOEM 2020-059, NMFS 2020 BiOp (NMFS 2020b) and amended ITS (NMFS 2021a), Appendix B
Hard Bottom Habitat Avoidance Mitigations	BOEM, BSEE	Bottom Disturbance, Offshore Habitat Modification/Space Use	BOEM NTL No. 2009-G39; BOEM NTL No. 2009-G40; Chapters 6, 7.6, and 7.9 of the GOM Oil and Gas SID
Topographic Features and Live Bottom Stipulations	BOEM, BSEE	Bottom Disturbance, Offshore Habitat Modification/Space Use	Chapters 6, 7.6, and 7.9 of the GOM Oil and Gas SID
Marine Mammal Protection Act	NOAA/NMFS	Offshore Habitat Modification/Space Use, Noise, Unintended Releases into the Environment, Strikes and Collisions	16 U.S.C. §§ 1361 *et seq.*; 50 CFR part 217 subpart S

[1] Refer to Chapter 6 of the GOM Oil and Gas SID for conditions of approval commonly applied at the post-lease stage.

4.8.2.1 OCS Oil- and Gas-Related Impact-Producing Factors from Routine Activities

Noise: The potential for noise impacts on marine mammals is highly variable and influenced by many factors (Greene Jr. and Moore 1995; Nowacek et al. 2007; Richardson et al. 1995; Southall et al. 2007; 2019; 2021b). Sound propagation through a particular environment depends on a variety of factors, including physical and oceanographic factors (e.g., salinity, temperature, bathymetry, seafloor type, and tow depth), sound characteristics associated with different sources (e.g., source level, directionality, source type, and duration for both impulsive or continuous signals), frequency (i.e., higher frequencies dissipate faster and lower frequencies may travel farther depending on water depth), and intensity (i.e., decibel level) (Greene Jr. and Moore 1995; Richardson et al. 1995; Southall et al. 2007; 2019; 2021b).

Marine mammal responses to sound from OCS oil- and gas-related activities, such as explosive severance methods for decommissioning, may include lethal or nonlethal injury, temporary hearing impairment, behavioral harassment and stress, or no apparent response (Nowacek et al. 2007). Most observations have been limited to short-term behavioral responses, which have included temporary cessation of feeding, resting, or social interactions; however, habitat abandonment can lead to more long-term effects. Masking may also occur, in which an animal may not be able to detect, interpret, and/or respond to biologically relevant sounds (Marine Mammal Commission 2007; Parks 2012).

Given that mysticetes (e.g., Rice's whales) produce calls that span a low-frequency range (20 Hz to 30 kHz) with their best hearing abilities presumably falling into this range as well, they would be most likely to experience impacts from the low-frequency sounds produced by seismic surveys (Richardson et al. 1995). In contrast, odontocetes (e.g., sperm whale) produce calls and hear best at mid to high frequencies (Richardson et al. 1995) and appear less vulnerable to low-frequency sound sources than mysticetes. Since most of the energy from airguns is radiated at frequencies below 200 Hz, low-frequency cetaceans would most likely hear the acoustic source that falls within their hearing range. Although low-frequency cetaceans would be expected to hear airguns, mid-frequency cetaceans have auditory bandwidths that overlap slightly with the frequencies of maximum airgun output. There is evidence that whales' closest points of approach to airgun arrays during seismic operations are substantially farther during full-power operations than during silence, indicating that there may be some avoidance response to the full-power operations (Barkaszi and Kelly 2019).

The potential effects of underwater sound from an active acoustic source could result in mortality, temporary hearing loss, permanent hearing loss, behavioral disturbance, stress, masking, and nonauditory physical or physiological effects (Nowacek et al. 2007; Richardson et al. 1995; Southall et al. 2007; 2019; 2021a; 2021b). The degree of the potential impact depends on the species' hearing frequency, sound characteristics, received level, distance of the animal from the sound source, and duration of the sound exposure. The Incidental Take Regulation (ITR) (50 CFR part 217 subpart S) under the MMPA authorizes incidental take of marine mammals from oil- and gas-related G&G activities and facilitates issuance of subsequent letters of authorization for individual G&G applicants. Further, BOEM-permitted activities implement mitigating measures for sound below 180 kHz during G&G survey activity (**Table 4.8-2**).

Low-frequency (less than 100 Hz) sound levels have shown to be higher offshore compared to the shelf break, likely due to more prevalent seismic airgun activities (Amaral et al. 2022) and greater depths (Barkaszi and Kelly 2019). Although the potential for adverse reactions to sound may vary considerably between individuals and species, sound exposure thresholds are useful to estimate when adverse reactions may be likely to occur in some measurable way that has potential significance to an animal. Sound exposure levels above certain thresholds, therefore, would have the greatest potential to disturb or cause injury (Ruppel et al. 2022). BOEM-permitted activities implement mitigating measures for sound below 180 kHz during G&G survey activity (**Table 4.8-2**). Chapter 4.7.1 of BOEM's Biological Environmental Background Report (BOEM 2021b) and Chapter 4.3.6.2.2 of the

GOM Oil and Gas SID (BOEM 2023e) contain additional information on potential noise impacts from OCS oil- and gas-related activities to marine mammals.

Offshore Habitat Modification/Space Use: Leasing on the OCS results in construction, operation, and decommissioning activities that occupy OCS space for dedicated uses that may be temporary or long term. Since lessees are required to perform OCS oil- and gas-related activities in accordance with regulatory requirements, long-term habitat modification is expected to be avoided. In the course of construction and operation activities, marine mammals can be exposed to entanglement and entrapment risks, such as from lines in the water (e.g., diver lines). Also, the placement or removal of infrastructure can create long-term alterations to the existing seascapes (i.e., the physical habitat) including seabed, water column, and/or sea-surface habitats. These modifications, from activities such as decommissioning via structure removal, infrastructure and/or pipeline emplacement, G&G surveys, and drilling, would likely be localized. Mitigating measures can reduce the risk of entanglement, use monitoring to visualize marine mammals, and avoid sensitive benthic habitats to reduce some of the potential impacts from the emplacement of infrastructure (**Table 4.8-2**).

Bottom Disturbance: Some marine mammals may use benthic or seafloor habitats for foraging and/or habitat. Bottom-disturbing activities could destroy hard bottom and/or submerged aquatic vegetation habitat that some marine mammals, such as Rice's whales or sperm whales, may depend on for feeding. However, the likelihood for any substantial portion of any marine mammal population to forage repeatedly around structures while disturbances are occurring would be very low given species distribution. The majority of the benthos in the GOM is ubiquitous soft bottom sediments. Rarer hard bottom and live bottom habitats have a more limited distribution. BOEM-permitted activities implement mitigating measures to avoid sensitive benthic resources (e.g., topographic features and live bottoms) that may be used by some marine mammals (**Table 4.8-2**), distancing OCS oil- and gas-related, bottom-disturbing activities from sensitive habitat that may be used by some marine mammals. Therefore, potential impacts from bottom disturbance are expected to be limited to a very abundant, soft sediment, habitat type, and any bottom areas affected would not constitute unique or unusual habitat (**Chapter 4.4**). Drilling would be localized and impacts are not expected to occur outside of the immediate area. In addition, bottom disturbance from infrastructure emplacement, pipeline trenching, and structure removal would be localized and temporary, and loss of live or hard bottom habitat is not expected. Further, many benthic species are mobile and can avoid bottom disturbance (**Chapter 4.4**). The benthic habitats used by the Florida manatee are in coastal, inland waters, which would not be within typical locations for OCS oil- and gas-related activities.

4.8.2.2 OCS Oil- and Gas-Related Impact-Producing Factors from Accidental Events

Unintended Releases into the Environment: Entanglement in marine debris could lead to injury, infection, reduced mobility, increased susceptibility to predation, decreased feeding ability, fitness consequences, and mortality (e.g., drowning) of marine mammals (Gall and Thompson 2015). Marine debris ingestion can lead to intestinal blockage, which could impact feeding ability and lead to injury or death (Gall and Thompson 2015). There are little data on marine debris specifically from OCS oil- and gas-related activities in the GOM (**Chapter 4.8.3**); therefore, it is difficult to determine the extent of the problem and its impacts on marine mammal populations. Lessees are required to perform OCS oil- and gas-related activities in accordance with regulatory requirements and therefore BSEE, USCG, and USEPA regulations, and BOEM guidance would be applied and strictly followed by OCS oil and gas operators, which would minimize unintended releases of marine debris (refer to **Table 4.8-2**).

Unintended releases of chemicals or oil into the marine environment may result in negative effects to marine mammals in the immediate area from exposures at harmful concentrations before the spill is contained and/or dissipates. If the discharge contained persistent and bioaccumulating pollutants, longer-term effects are possible over a broader area through dietary exposure and bioaccumulation.

Potential impacts of an oil spill depend on a variety of factors, such as spill magnitude, frequency, timing, location, and the meteorological and oceanographic conditions at the time (National Research Council 2003b). The impacts of an oil spill on marine mammals could depend on many external variables, such as oil characteristics; time of year; response efforts (e.g., burning, dispersant); and types of habitats, as well as the behavior and physiology of the marine mammals themselves (Johnson and Ziccardi 2006; Sullivan et al. 2019; Ziccardi et al. 2015). Further, timing and location would also contribute to determining which species may be affected and the scale of the effect.

Several factors increase the probability of oil exposure to an individual marine mammal, including (1) marine mammals often travel long distances in the GOM, increasing the geographic areas of potential impact; (2) marine mammals are relatively long-lived and have many years during which they may be exposed (natural seeps or otherwise); and (3) some spills would be larger, increasing the area of potential impact. It is impossible to know precisely which cetacean species, population, or individuals would be impacted, to what magnitude, or in what numbers since each species has unique and/or lack of distribution patterns in the GOM and because of difficulties attributed to predicting when and where oil spills could occur. Potential impacts to marine mammals from an oil spill are expected to increase with spill size. Marine mammals typically would actively avoid poor environmental conditions. In most cases, the majority of oil is found at the water’s surface during a spill. Due to the relatively short time spent at the water’s surface overall depending on species and time of day, it is unlikely that marine mammals would spend prolonged periods of time in close proximity to the majority of the oil in a spill and/or associated response activities if deployed.

Marine mammals could be affected by oil spills through various pathways: direct surface contact; inhalation of volatile components; or ingestion (via direct ingestion or by the ingestion of contaminated prey). These pathways could affect marine mammals by leading to, decreased health, reproductive fitness, and longevity, increased vulnerability to disease, and possibly mortality. The oil from a spill can adversely affect marine mammals by causing soft-tissue irritation, fouling of baleen plates, respiratory stress from the inhalation of toxic fumes, food reduction or contamination, direct ingestion of oil and/or tar, and temporary displacement from preferred habitats. There is evidence that some species of marine mammals can metabolize hydrocarbons (Engelhardt 1983; Lee and Anderson 2005). However, the extent to which species metabolize and eliminate hydrocarbons, and the specific gene biomarker pathways used are unclear (Ruberg et al. 2021). The long-term impacts to marine mammal populations are poorly understood (**Chapter 4.8.3**). An oil spill may physiologically stress an animal (Geraci and St. Aubin 1980), making it more vulnerable to disease, parasitism, environmental contaminants, and/or predation. Oil spills may also affect feeding behavior, especially in the case of baleen whales with fouled baleen plates (Geraci and St. Aubin 1990). In any case, the impact could negatively impact a marine mammal population or stock.

Most oil spills are <50 bbl and are expected to disperse quickly in the open ocean. However, a spill >10,000 bbl was documented off the Louisiana coast in November 2023; the investigation is currently ongoing (**Chapter 3.5.1**). It is unlikely a small spill would cause mortality or life-threatening injury of individual marine mammals or the long-term displacement of marine mammals from preferred feeding, breeding, or calving areas. Cetaceans may not avoid larger oil spills and could experience long-lasting impacts, including reduced reproduction, increased disease, and death (Michel 2021). These impacts were documented in cetaceans that were resident in semi-enclosed, heavily oiled (i.e., >20,000 bbl) waterbodies. The difficulty in determining impacts to marine mammals is the lack of accurate stock assessments to establish a baseline with influences from other long-standing anthropogenic continuous sources to stocks while incorporating into proper modeling techniques (Michel 2021). Chapters 4.7.8.1 and 4.7.8.3 of BOEM's Biological Environmental Background Report (BOEM 2021b) and Chapter 4.3.6.2.3 of the GOM Oil and Gas SID contain additional information on potential impacts from OCS oil- and gas-related unintended releases into the environment to marine mammals.

Response Activities: Spill-response activities that may impact marine mammals include increased vessel traffic, the use of dispersants, and remediation activities (e.g., controlled burns, skimmers, boom, etc.). The increased human presence in the water after an oil spill (e.g., vessels) would likely add to changes in behavior and/or distribution, thereby potentially stressing affected marine mammals further, possibly making them more vulnerable to various physiologic and toxic effects of spilled oil.

Little is known about the impacts of oil dispersants on cetaceans (**Chapter 4.8.3**), except that removing oil from the surface would reduce the risk of oil contact and render it less likely to adhere to the skin or other body surfaces (Neff 1990). However, it is difficult to determine how these exposures relate to the actual exposures in the GOM since there is no known accurate method to measure the amount of whale exposure to dispersants (Wise et al. 2014). Impacts from dispersants are unknown though they may be irritants to tissues and sensitive membranes (National Research Council 2005) and could cause non-lethal injury such as tissue irritation, inhalation, long-term exposure through bioaccumulation, and potential shifts in distribution from some habitats.

Skimmers could capture and/or entrain individuals. In both skimming and controlled (i.e., *in situ*) burning activities, the use of trained observers is common. The low probability of marine mammals being in the vicinity of an OCS oil- and gas-related oil-spill response activity due to their wide-ranging behavior reduces the likelihood of impacts to marine mammals. Through the National Contingency Plan (40 CFR part 300) and the Federal laws that underpin this regulation, there are mitigations and plans in place at the Federal, State, and local levels (e.g., from USCG, BSEE, States, NMFS, FWS, and NPS) that decrease impacts to marine mammals during response activities (**Table 4.8-2**). These plans increase surveillance and the detection of animals, thus reducing potential impacts through avoidance measures. Lessees are required to perform OCS oil- and gas-related activities in accordance with regulatory requirements. Chapter 4.7.8.2 of BOEM's Biological Environmental Background Report (BOEM 2021b) and Chapter 4.3.6.2.3 of the GOM Oil and Gas SID (BOEM 2023e) contain additional information on potential impacts from OCS oil- and gas-related response activities to marine mammals. **Chapter 3.5.2** of this Programmatic EIS provides more detail on oil spill response duties and responsibilities.

Strikes and Collisions: Many marine mammal species are vulnerable to vessel strikes, which can result in injury or death (Laist et al. 2001; Pace 2011; Van Waerebeek et al. 2007; Vanderlaan and Taggart 2007). Several factors affect the risk and severity of vessel strike to marine mammals, including species type, speed, health, and behavior of the animal and the path, speed, size, and number of vessels (Laist et al. 2001; Martin et al. 2016; Vanderlaan and Taggart 2007). For example, Rice's whales typically spend most of their time within 15 m (50 ft) of the ocean's surface, such as when resting, which makes them vulnerable to vessel strikes (NMFS 2023h). Deep-diving sperm whales are also vulnerable to vessel strikes because they require several minutes to recover from extended, deep dives (Fais et al. 2016; Vanderlaan and Taggart 2007). Reports of vessel strikes by OCS oil- and gas- related vessels are quite rare; the only known and documented strike of a sperm whale by an OCS oil- and gas-related vessel occurred in December 2020, while the vessel was transiting to its service base in Galveston, Texas. The strike was reported to the necessary contacts and the Sperm Whale Vessel Strike Compliance Verification Report prepared by BSEE found that all applicable regulatory requirements, programmatic terms and conditions, and COAs had been followed by the vessel.

Most reported vessel strikes involve large whales though collisions with smaller species also occur. Most severe and lethal whale injuries involve large ships (>262 ft [80 m]) at higher speeds; 89 percent of ship strike records show that vessels were moving >16 mph (14 kn), most strikes occurred over or near the continental shelf, and the whales were usually not seen beforehand or seen too late to be avoided (Laist et al. 2001; Van Waerebeek et al. 2007). BOEM-permitted activities implement mitigating measures for vessel strikes during activity (**Table 4.8-2**), which would prevent or significantly reduce marine mammal interactions with transiting vessels. Chapter 4.7.8.4 of BOEM's Biological Environmental Background Report (BOEM 2021b) and Chapter 4.3.6.2.3 of the GOM Oil and Gas SID contain additional information.

4.8.2.3 Alternatives Analysis

Alternative A – No Action (Cancellation of a Single Proposed OCS Oil and Gas Lease Sale)

Under Alternative A, a proposed lease sale would not occur so there would be no new routine activities or accidental events resulting from the proposed action. Therefore, no direct or indirect impacts to marine mammals would occur as a result of the proposed action (i.e., a proposed oil and gas lease sale) and impacts would be **none**. However, there are ongoing OCS oil- and gas-related activities and other non-OCS oil- and gas-related activities that contribute to the baseline environment (summarized in **Chapter 4.0.1** of this Programmatic EIS with more detail in Chapter 3 of the GOM Oil and Gas SID) that also affect marine mammals and would still occur. Ongoing activities associated with previous OCS oil and gas lease sales (**Table 3.3-2**) could still have potential direct impacts to marine mammals through noise, offshore habitat modification/space use, bottom disturbance, unintended releases into the environment, response activities, and strikes and collisions as summarized above in **Chapter 4.8.2.2** and in greater detail in Chapter 4.3.6 of the GOM Oil and Gas SID and evaluated as part of the cumulative analysis in **Chapter 4.17.8**.

Comparison of Impacts under Alternatives B, C, and D

A proposed regionwide OCS oil and gas lease sale under Alternatives B through D, and the resulting OCS oil- and gas-related development on any subsequent leases from the proposed OCS lease sale, could result in noise, offshore habitat modification/space use, bottom disturbance; unintended releases into the environment, response activities, and strikes and collisions that could potentially impact marine mammals.

Alternative B represents the largest geographic area under consideration for a proposed regionwide OCS oil and gas lease sale. Alternatives C and D represent geographical constraints on available acreage for leasing, which could change the spatial distribution of the scenario activities, but not their overall activity levels. Therefore, this alternatives analysis is focused on the potential environmental impacts of a proposed regionwide OCS oil and gas lease sale (Alternative B) and then considers if these potential impacts could be reduced by the geographic constraint under each alternative considered (Alternatives C and D).

Table 4.8-3 shows the impact determinations for each IPF that affects marine mammals for each action alternative analyzed. Impacts are shown both with and without the mitigating effects of BOEM's protective measure(s) being considered in this Programmatic EIS, if applicable to that IPF. The impacts of Alternative A are not shown in **Table 4.8-3** because an oil and gas lease sale would not occur, and the impacts for all IPFs from the proposed action would be **none**.

Table 4.8-3. Impact Determinations for Routine and Accidental Impacts to Marine Mammals for Alternatives B-D.

Impact-Producing Factor	BOEM's Protective Measure(s)[1]	Alternative B	Alternative C	Alternative D
Noise	Without Protective Measures	**Negligible** to **Moderate**	**Negligible** to **Moderate**	**Negligible** to **Moderate**
Noise	With Protective Measures	**Negligible** to **Minor**	**Negligible** to **Minor**	**Negligible** to **Minor**
Offshore Habitat Modification/ Space Use	Without Protective Measures	**Negligible** to **Moderate**	**None** in excluded areas; **Negligible** to **Moderate** in leased areas only	**None** in excluded areas; **Negligible** to **Moderate** in leased areas only

Impact-Producing Factor	BOEM's Protective Measure(s)[1]	Alternative B	Alternative C	Alternative D
Offshore Habitat Modification/ Space Use	With Protective Measures	**Negligible**	**None** in excluded areas; **Negligible** in leased areas only	**None** in excluded areas; **Negligible** in leased areas only
Bottom Disturbance	Without Protective Measures	**Negligible** to **Minor**	**None** in excluded areas; **Negligible to Minor** in leased areas only	**None** in excluded areas; **Negligible to Minor** in leased areas only
Bottom Disturbance	With Protective Measures	**Negligible**	**None** in excluded areas; **Negligible** in leased areas only	**None** in excluded areas; **Negligible** in leased areas only
Unintended Releases into the Environment (marine debris)	Without Protective Measures	**Negligible** to **Moderate**	**Negligible** to **Moderate**	**Negligible** to **Moderate**
Unintended Releases into the Environment (marine debris)	With Protective Measures	**Negligible**	**Negligible**	**Negligible**
Unintended Releases into the Environment (oil spills)	N/A	**Negligible** to **Moderate**	**Negligible** to **Moderate**	**Negligible** to **Moderate**
Response Activities	N/A	**Negligible** to **Minor**	**Negligible** to **Minor**	**Negligible** to **Minor**
Strikes and Collisions	Without Protective Measures	**Negligible** to **Major**	**Negligible** to **Major**	**Negligible** to **Major**
Strikes and Collisions	With Protective Measures	**Negligible** to **Moderate**[2]	**Negligible** to **Moderate**[2]	**Negligible** to **Moderate**[2]

Note: Alternative A is not shown in the table because the impacts from all impact-producing factors is **none**.

[1] Protective measures for application at the OCS lease sale stage are being contemplated in this Programmatic EIS. Additional BOEM protective measures for marine mammals would be considered at the site-specific stage in compliance with existing and future regulatory and consultation requirements. In the unlikely event of a strike on an ESA listed whale, the determination could be up to **major**.

Alternative B – Regionwide OCS Lease Sale

Noise: Alternative B considers a proposed regionwide OCS lease sale area. Within this geographic area, **noise** can occur from any routine OCS oil- and gas-related activity (**Table 3.3-4**). Given the level of these activities described in **Table 3.3-2** for a single proposed OCS oil and gas lease sale to occur over a 40-year lifespan, impacts to marine mammals could occur in the vicinity of a sound source (e.g., G&G survey). Noise has the potential to cause lethal or nonlethal injury, temporary hearing impairment, permanent hearing impairment, behavioral effects, and/or stress, or no apparent response. The impacts would be **negligible** to **moderate** when mitigating measures (**Table 4.8-2**) are not utilized since marine mammals would not be observed during OCS oil- and gas-related activities and could be exposed to noise at levels that could cause lethal or nonlethal injury (e.g., temporary or permanent hearing impairment), behavioral effects, and/or stress. When mitigating measures are utilized, impacts are expected to be **negligible** to **minor**. Applicable mitigating measures like the Protected Species Stipulation and the 2020 NMFS BiOp as amended terms and conditions (refer to **Table 4.8-2**) would prevent or substantially reduce marine mammal noise exposure by requiring visual and acoustic monitoring, and waiting periods (i.e., detonation delay) for explosive structure removals. Appendix A of the amended ITS (NMFS 2021a) (**Table 4.8-2**) would prevent or substantially reduce marine mammal noise exposure from seismic surveys by requiring visual and acoustic monitoring (e.g., pre-clearance observation) and seismic survey protocols (e.g., seismic source ramp-up intended to warn marine mammals, shut-down upon observation, and time-area closures). Additionally, the Pile Driving Monitoring and Reporting Requirements COA would prevent or reduce marine mammal noise exposure from pile-driving activities by requiring visual monitoring by protected species observers prior to the start of activity, soft starts, and shutdowns.

Offshore Habitat Modification/Space Use: Offshore habitat modification/space use can occur from any routine OCS oil- and gas-related activity except for G&G survey activity, service vessel trips, and helicopter operations (**Table 3.3-4**). Given the level of these activities described in **Table 3.3-2** for a single proposed OCS oil and gas lease sale to occur over a 40-year lifespan, impacts to marine mammals could occur in the vicinity of routine OCS oil- and gas-related construction, operation, and decommissioning activities. Offshore habitat modification/space use has the potential to cause behavioral effects, decreased feeding ability, reduced mobility, stress, injury, or death. The impacts would be is **negligible** to **moderate** when mitigating measures (**Table 4.8-2**) are not utilized since some marine mammals would be exposed to disturbance from construction, operation, and decommissioning activities, including slack-lines in the water with entanglement risk, which could cause reduced mobility, stress, injury, or death. Impacts are expected to be **negligible** when mitigating measures are utilized because there would be no measurable or detectable impacts on marine mammals. Applicable mitigating measures, such as the Protected Species Stipulation; 2020 NMFS BiOp, as amended, Slack-line Precautions COA, Moon Pool Monitoring COA, and Reporting Requirements COA (NMFS 2020b; 2021a); as well as NTL No. 2009-G39; Topographic Features Stipulation; and Live Bottom Stipulation (**Table 4.8-2**) would prevent or substantially reduce marine mammal interactions with construction, operation, and decommissioning activities by requiring lines in the water to be taut, which would prevent or substantially reduce entanglement risk, requiring monitoring, requiring reporting requirements, and requiring avoidance distances from sensitive benthos that some marine mammals may use. Additionally, the Pile Driving Monitoring and Reporting Requirements COA would prevent or reduce marine mammal interactions with pile-driving activities by requiring visual monitoring by protected species observers prior to the start of activity, soft starts, and shutdowns.

Bottom Disturbance: Bottom Disturbance can occur from any routine OCS oil- and gas-related activity, except for service vessel trips and helicopter operations (**Table 3.3-4**). Given the level of these activities described in **Table 3.3-2** for a single proposed OCS oil and gas lease sale to occur over a 40-year lifespan, impacts to marine mammals in the vicinity of bottom-disturbing activities, such as drilling, are expected to be relatively undetectable. Bottom disturbance has the potential to displace some marine mammals from foraging grounds and/or preferred habitat. The impact would be **negligible** to **minor** when mitigating measures (**Table 4.8-2**) are not used, since some marine mammals would experience reduced foraging and/or preferred habitat. Impacts are expected to be **negligible** when mitigating measures are used because there would be no measurable or detectable impacts on marine mammals. Applicable mitigating measures, such as the Topographic Features Stipulation and Live Bottom Stipulation (**Table 4.8-2**) would prevent or substantially reduce marine mammal interactions with bottom-disturbing activities by requiring avoidance distances from sensitive benthic habitats (e.g., live bottoms) that some marine mammals may use for foraging and/or as habitat.

Unintended Releases into the Environment: Unintended releases into the environment from accidental marine debris can occur from any routine OCS oil- and gas-related activity (**Table 3.3-4**). Given the level of these activities described in **Table 3.3-2** for a single proposed OCS oil and gas lease sale to occur over a 40-year lifespan, impacts to marine mammals could occur in the immediate vicinity of the accidental marine debris. Accidental marine debris entanglement, entrapment, or ingestion can lead to stress, infection, decreased health, reduced mobility, injury, and/or death. The impact from accidental marine debris is **negligible** to **moderate** when mitigating measures (**Table 4.8-2**) are not utilized since marine mammals would be more vulnerable to impacts from accidental marine debris without protective protocols in place aimed at preventing accidental marine debris. The impacts from accidental marine debris to marine mammals would be **negligible** when mitigating measures are utilized because there would be no measurable or detectable impacts on marine mammals. Applicable mitigating measures, such as the Protected Species Stipulation and 2020 NMFS BiOp, as amended, Appendix B (Gulf of Mexico Marine Trash and Debris Awareness and Elimination Survey Protocols) (NMFS 2020b; 2021a) (**Table 4.8-2**) would prevent or substantially reduce accidental marine debris, thereby preventing or substantially reducing marine mammal risk from entanglement, entrapment, or ingestion.

Unintended releases into the environment from accidental oil spills can occur from any routine OCS oil- and gas-related activity (**Table 3.3-4**). Given the effects of an accidental spill would depend on the volume of the spill and time before it is actively removed as part of a spill response or naturally weathers (**Chapter 3.5.1.1**), impacts to marine mammals could occur in the vicinity of an accidental oil spill in the OCS. Unintended releases into the environment from accidental spills could cause injury, infection, reduced mobility, increased susceptibility to predation, decreased feeding ability, fitness consequences, increased vulnerability to disease, decreased health, decreased reproductive fitness, and/or death, depending on the spill size. Potential impacts are expected to increase with spill size. Thus, given the number and volume of accidental oil spills estimated for a single OCS oil and gas lease sale (Ji and Schiff 2023) and the wide-ranging movements and distribution of marine mammals, the impacts from unintended releases into the environment from accidental oil spills to marine mammals would be **negligible** to **moderate**.

Response Activities: Response activities can occur from any routine OCS oil- and gas-related activity except for G&G survey activity and helicopter operations (**Table 3.3-4**). Given the scale and effects of response activities would depend on the volume of the spill (**Chapter 3.5.1.1**), impacts to marine mammals could occur in the vicinity of spill-response activities on the OCS. Response activities, including increased vessel traffic, the use of dispersants, and remediation activities, could cause changes in behavior and/or distribution, thereby potentially stressing affected marine mammals further, possibly making them more vulnerable to various physiological and toxic effects of spilled oil. The scale of response activities (e.g., vessel and dispersant use) and the potential impacts to marine mammals are expected to increase with spill size. Thus, given the likely non-catastrophic spill size, if it were to occur (Ji and Schiff 2023, Chapter 3), subsequent response activities expected to occur in a limited area, the wide-ranging movements and distribution of marine mammals, and the spill response plans and safety protocols (e.g., National Contingency Plans) in which lessees are required to perform OCS oil- and gas-related activities in accordance (**Table 4.8-2**), the impacts from response activities to marine mammals would be **negligible** to **minor**.

Strikes and collisions: can occur from the routine OCS oil- and gas-related activity of G&G survey activity, production structures removed using explosives, other structure removal, service-vessel trips, and helicopter operations (**Table 3.3-4**). Given the level of this activity described in **Table 3.3-2** for a single proposed OCS oil and gas lease sale to occur over a 40-year lifespan, impacts to marine mammals could occur in the immediate vicinity of transiting vessels. If a vessel strike were to occur, the outcome could range from no apparent injury to mortality to the struck individual. Although vessel strikes to marine mammals are rare, the impact of mortality from vessel strike could be major due to the potential for population-level effects on particularly vulnerable species, such as the Rice's whale. The impact is **negligible** to **major** when mitigating measures (**Table 4.8-2**) are not utilized since marine mammals would be more vulnerable to vessel strikes without speed restrictions, separation distances, and the use of protected species observers, potentially causing injury or death. Applicable mitigating measures, such as The Protected Species Stipulation and 2020 NMFS BiOp, as amended Appendix C (Vessel Strike Avoidance and Injured/Dead Aquatic Protected Species Reporting Protocols) and Notification of Intention to Transit Rice's Whale Area COA (NMFS 2021a) (**Table 4.8-2**), require vigilant monitoring for marine mammals during transit and maintaining a separation distance while underway if marine mammals are detected. These requirements reduce the potential for vessel strikes or collisions and obligate operators to report them. With the application of mitigating measures, the impacts from accidental strikes and collisions to marine mammals would range from **negligible** to **moderate** for most marine mammals, but they could range up to **major** for ESA-listed whales in the unlikely event of a strike(s) that resulted in population-level effects to the extent the viability of the population was diminished.

Therefore, based on the description of the IPFs above and the scenario projections for a single proposed OCS oil and gas lease sale provided in **Chapter 3**, the overall impacts from IPFs associated with Alternative B on marine mammals could be **negligible** to **major** without applicable measures in place to protect marine mammals from harmful levels of noise; slack-lines in the water; bottom disturbance; accidental marine debris entanglement, entrapment, or ingestion; accidental vessel strikes; accidental oil-spill contact; and spill-response activities. When mitigating measures, including the Topographic Features and Live Bottom Stipulations; NTL No. 2009-G39; Protected Species Stipulation; Pile Driving Monitoring and Reporting Requirements COA; Notification of Intention to Transit Rice's Whale Area COA; in addition to 2020 NMFS BiOp, as amended, Slack-line Precautions COA, Moon Pool Monitoring COA, Reporting Requirements COA, and Appendices A, B, C, and I (NMFS 2020b; 2021a) are utilized, this impact would be **negligible** to **moderate** because exposures to the IPFs would be substantially reduced or avoided. Further, the Notification of Intention to Transit

Rice's Whale Area COA avoids or mitigates potential vessel interactions with Rice's whales in the northeastern GOM. Given the proposed critical habitat for the Rice's whale (88 FR 47453), additional mitigations through ESA consultation may be applied as necessary as part of a lease sale or during post-lease reviews, after consultation with NMFS.

Alternative C – Inflation Reduction Act Targeted OCS Lease Sale Area

Alternative C represents a geographical constraint on available acreage for leasing, which would cause a change in the spatial distribution of activities compared to Alternative B, but not the types of activities or overall activity levels. Most impacts to marine mammals from routine OCS oil- and gas-related activities are not expected to occur in areas removed from potential leasing under Alternative C because, as discussed under Alternative B, areas of impacts from routine OCS oil- and gas-related activities occur within limited areas surrounding activity, and these activities would not occur in excluded areas. Impacts from most routine activities would be limited to the areas leased under this alternative. One exception is noise, which could potentially travel from the sound source into excluded areas, resulting in impacts to marine mammals. The impacts from accidental events would be the same as described for Alternative B, including strikes from vessel traffic, which can occur throughout the GOM from port to lease activity. In addition, oil spills and response activities could occur in the excluded areas. However, this potential spatial redistribution of activity does not affect impact levels for marine mammals because they are widely distributed throughout the GOM.

Therefore, based on the description of the IPFs above and the scenario projections for a single proposed OCS oil and gas lease sale provided in **Chapter 3**, the overall impacts from IPFs associated with Alternatives C on marine mammals would be **negligible** to **major** if applicable measures are not in place to mitigate IPF impacts (e.g., vessel strike, noise injury, entanglement in lines, bottom disturbance, accidental oil spill- contact, spill remediation interactions, or accidental marine debris entanglement, entrapment, or ingestion) to marine mammals. When mitigating measures, including the Topographic Features and Live Bottom Stipulations; NTL No. 2009-G39; Protected Species Stipulation; Pile Driving Monitoring and Reporting Requirements COA; Slack-line Precautions COA; Moon Pool Monitoring COA; Reporting Requirements COA; Notification of Intention to Transit Rice's Whale Area COA; and Appendices A, B, C, and I are utilized, this impact would be **negligible** to **moderate** because exposures to the IPFs would be substantially reduced or avoided.

Alternative D – Targeted OCS Lease Sale Area with Additional Exclusions

Alternative D represents a further geographical constraint on available acreage for leasing, which would cause a change in the spatial distribution of activities compared to Alternatives B and C, but not the types of activities or overall activity levels. Most impacts to marine mammals from routine OCS oil- and gas-related activities are not expected to occur in areas removed from potential leasing under Alternative D because, as discussed under Alternative B, areas of impacts from routine OCS oil- and gas-related activities occur within limited areas surrounding activity, and these activities would not occur in excluded areas. Impacts from most routine activities would be limited to the areas leased under this alternative. One exception is noise, which could potentially travel from the sound source into excluded areas, resulting in impacts to marine mammals. The impacts from accidental events would be the same as described for Alternative B, including strikes from vessel traffic, which can occur throughout the GOM from port to lease activity. In addition, oil spills and response activities could occur in the excluded areas. However, this potential spatial redistribution of activity, which could increase vessel traffic through the 100- to 400-m (328- to 1,312-ft) isobath, does not affect impact levels to marine mammals because they are widely distributed throughout the GOM, and given the application of mitigating measures (i.e., Appendix C and Notification of Intention to Transit Rice's Whale Area COA), which would substantially reduce or avoid potential vessel interactions.

Therefore, based on the description of the IPFs above and the scenario projections for a single proposed OCS oil and gas lease sale provided in **Chapter 3**, the overall impacts from IPFs associated with Alternatives D on marine mammals would be **negligible** to **major** if applicable measures are not in place to mitigate IPF impacts (e.g., vessel strike, noise injury, entanglement in lines, bottom disturbance, accidental oil spill contact, spill remediation interactions, or accidental marine debris entanglement, entrapment, or ingestion) to marine mammals. When mitigating measures, including the Topographic Features and Live Bottom Stipulations; NTL No. 2009-G39; Protected Species Stipulation; Pile Driving Monitoring and Reporting Requirements COA; and 2020 NMFS BiOp, as amended, Slack-line Precautions COA; Moon Pool Monitoring COA; Reporting Requirements COA; Notification of Intention to Transit Rice's Whale Area COA; and Appendices A, B, C, and I (NMFS 2020b; 2021a) are utilized, this impact would be **negligible** to **moderate** because exposures to the IPFs would be substantially reduced or avoided, thereby substantially reducing or eliminating IPF impacts to marine mammals.

4.8.3 Incomplete or Unavailable Information

BOEM has identified incomplete or unavailable information that may be relevant to reasonably foreseeable impacts on marine mammals. Such information includes impacts from climate change, marine debris, accidental oil spills, and spill-response activities on marine mammals in the GOM, which can be difficult to quantify. There is also incomplete information on the full extent of the Rice's whale range, spatial density, and population abundance in the GOM. BOEM has determined that such information is not essential to a reasoned choice among alternatives because none of the available scientific publications reveal reasonably foreseeable significant adverse impacts to marine mammals not otherwise considered in this Programmatic EIS. BOEM's subject-matter experts have used publicly available scientifically credible evidence presented herein and applied accepted scientific methodologies to integrate existing information qualitatively and quantitatively (if available) and extrapolated potential outcomes in completing this analysis and formulating any conclusions. Therefore, the incomplete or unavailable information, while relevant, would not likely change the impact conclusions reached in this analysis and is not essential to a reasoned choice among alternatives.

4.9 SEA TURTLES

Five species of sea turtles occur in the GOM: the loggerhead turtle; green sea turtle; hawksbill sea turtle; Kemp's ridley sea turtle; and leatherback sea turtle. Of these, the Northwest Atlantic Ocean Distinct Population Segment (DPS) of loggerhead sea turtle and the North Atlantic DPS of green sea turtle are ESA-listed as threatened (79 FR 39856). The hawksbill turtle, Kemp's ridley turtle, leatherback turtle, and breeding populations of green sea turtle in Florida are ESA-listed as endangered. The FWS and NMFS share jurisdiction for sea turtles. The FWS has jurisdiction for sea turtles in the terrestrial environment, including monitoring and managing sea turtles (i.e., nesting turtles, eggs, and hatchlings) on beaches. The NMFS has jurisdiction for sea turtles in the marine environment for activities that affect sea turtles and their habitats offshore.

4.9.1 Affected Environment

Of the five sea turtle species, some utilize the GOM for the majority of their life cycle, such as the Kemp's ridley, while other species such as leatherback and green sea turtles may utilize the waters of the GOM for migrating and foraging. It is assumed that all species are broadly distributed, and many sea turtle species have wide-ranging migrations both within and outside of the GOM. Recent tagging and tracking studies have provided additional information on sea turtle habitat use in the northern GOM. Evans et al. (2021) evaluated satellite telemetry of female leatherback sea turtles over a 15-year period and found that portions of the GOM (i.e., the Florida Panhandle area, south Louisiana, and the Bay of Campeche) were utilized as residential areas for nesting females rather than migratory or pass-through regions. Gredzens and Shaver (2020) estimated that up to 82 percent of adult female Kemp's ridley sea turtles may use the northern GOM, particularly waters shoreward of the 100-m (328-ft) isobath, as their primary foraging area post-nesting. In 2022, Kemp's ridley hatchlings were discovered on the Chandeleur Islands, confirming nesting for the first time in 75 years (DOI 2022). Juvenile green sea turtles utilize coastal Texas inland bays in the fall and summer before migrating south to Mexico and the Mexico-Texas border (Metz et al. 2020). Green sea turtles nesting on southwest Florida mainland beaches use areas off Cape Sable (Everglades) and the Marquesas Key as inter-nesting and foraging habitats (Lamont et al. 2023; Sloan et al. 2022). Floating *Sargassum* patches in the CPA and WPA are used by juvenile sea turtles as habitat and for foraging. *Sargassum* is federally designated under the ESA as critical habitat for loggerhead turtles (79 FR 39856). Critical habitat is currently proposed by the FWS (88 FR 46376) and NMFS (88 FR 46572) for the green sea turtle in the GOM. The NMFS proposed areas from the mean high water line to the 20-m (66-ft) depth in Florida and Texas and within *Sargassum* habitat in the EPA, CPA, and WPA (88 FR 46572). The FWS proposed nesting beaches in the Florida mainland, Boca Grande and Marquesas Keys, and the Dry Tortugas (88 FR 46376).

More information on the general description of sea turtles can be found in the 2018 FWS BiOp (FWS 2018), 2020 NMFS BiOp, as amended (NMFS 2020b), and Chapter 4.3.7.1 of the GOM Oil and Gas SID (BOEM 2023e).

4.9.2 Environmental Consequences

Sea turtles in the GOM are affected by existing environmental conditions, natural processes and phenomena, and human-induced factors. Chapter 4.3.7.1 of the GOM Oil and Gas SID describes the programmatic concerns influencing sea turtles, i.e., climate change and disease. There are also several OCS oil- and gas-related activities and non-OCS oil- and gas-related activities that have the potential to impact sea turtles. BOEM conducted an initial screening of IPFs in the GOM Oil and Gas

SID and determined that noise, offshore habitat modification/space use, bottom disturbance, lighting and visual impacts, unintended releases into the environment, response activities, and strikes and collisions could potentially impact sea turtles. These IPFs and their potential to affect sea turtles are discussed below and in greater detail in Chapter 4.3.7.2 of the GOM Oil and Gas SID. Bottom disturbance was initially scoped out in the GOM Oil and Gas SID but has since been determined to impact sea turtles and is included in this analysis. Supporting rationale for the IPFs that were not analyzed in detail in this Programmatic EIS can be found in Chapter 4.3.7 of the GOM Oil and Gas SID. New information released since the development of the GOM Oil and Gas SID and relevant to the analysis is included in the applicable chapters below.

Table 4.9-1. Impact-Producing Factors with the Potential to Impact Sea Turtles.

OCS Oil- and Gas-Related Routine Activities	OCS Oil- and Gas-Related Accidental Events	Non-OCS Oil- and Gas-Related Activities
Noise	Unintended Releases into the Environment	Noise
Offshore Habitat Modification/Space Use	Response Activities	Discharges and Wastes
Bottom Disturbance	Strikes and Collisions	Coastal Land Use/Modification
Lighting and Visual Impacts	-	Lighting and Visual Impacts
-	-	Offshore Habitat Modification/ Space Use
-	-	Bottom Disturbance
-	-	Strikes and Collisions
-	-	Climate Change
-	-	Natural Processes

There are several existing regulatory programs and protective measures that reduce or minimize the environmental effects of these IPFs to sea turtles in the GOM. Regulatory requirements enforced by BOEM, BSEE, and other agencies are outlined in **Table 4.9-2** and further described in the *Gulf of Mexico OCS Regulatory Framework* technical report (BOEM 2020a). The protective measures and regulatory requirements listed in **Table 4.9-2** reduce impacts to sea turtles by reducing noise exposure, requiring avoidance distances from sensitive benthos, requiring precautions for lines in the water, requiring safety measures for accidental oil spills and spills response, reducing or eliminating accidental trash and debris, and preventing or reducing and reporting vessel strikes.

Lessees are required to perform OCS oil- and gas-related activities in accordance with all regulatory requirements, including existing and future consultation requirements under the ESA and other statutes. Therefore, this analysis factors in the mitigating effects of all applicable regulatory requirements as part of the proposed action when making impact determinations. Compliance with existing and future consultation requirements[10] – by BOEM as well as individual operators and lessees, as required – may result in additional mitigating measures or updates to the existing measures described throughout this chapter. Through adaptive management, BOEM would incorporate new or updated measures resulting from ongoing or future consultations into post-lease plan reviews and authorizations, as appropriate (Chapter 6 of the GOM Oil and Gas SID).

Table 4.9-2. Existing Regulatory Requirements and Protective Measures That Reduce the Potential Impacts of Impact-Producing Factors.

Regulatory Requirement or Protective Measure[1]	Enforcing Agency	Impact-Producing Factor(s) Reduced/Avoided	Supporting References and Sections
Protected Species Stipulation	BOEM	Offshore Habitat Modification/ Space Use, Noise, Unintended Releases into the Environment, and Strikes and Collisions	Chapters 6 and 7.5 of the GOM Oil and Gas SID
OCSLA	BOEM, BSEE	Offshore Habitat Modification/ Space Use	43 U.S.C. § 1331, OCS Report BOEM 2020-059 (BOEM 2020a)
CZMA	NOAA, States	Coastal Land Use/Modification	16 U.S.C. § 1251 and 15 CFR part 930, OCS Report BOEM 2020-059 (BOEM 2020a)
ESA	FWS, NOAA, NMFS	Noise, Offshore Habitat Modification/Space Use, Strikes and Collisions, Coastal Land Use/Modification	2018 FWS BiOp; OCS Report BOEM 2020-059, Chapter 5; 2020 NMFS BiOp (NMFS 2020b) and amended ITS (NMFS 2021a) Appendix A, Appendix B, Appendix C Appendix I, Appendix J, Moon Pool Monitoring COA, Slack-line Precautions COA, Reporting Requirements COA, Pile Driving Monitoring and Reporting Requirements COA
National Marine Sanctuaries Act – Flower Garden Banks National Marine Sanctuary, including NMSA 304(d)	NOAA, ONMS	Noise, Bottom Disturbance	15 CFR part 922 subpart L; 16 U.S.C. § 1434(d)

[10] For example, a plan approval would be conditioned upon compliance with the applicable Reasonable and Prudent Measures and Terms and Conditions of the most recent Biological Opinion issued by the NMFS at the time of the site-specific review (**Appendix A.3**). This includes adaptively managing the mitigation, monitoring, and reporting requirements (2020 BiOp Appendices, as amended, and/or COAs) imposed by the Bureaus on plans and permits, and as coordinated with NMFS and industry. Any future BiOp amendments or COAs shall be a requirement and binding on subsequent BOEM authorizations.

Regulatory Requirement or Protective Measure[1]	Enforcing Agency	Impact-Producing Factor(s) Reduced/Avoided	Supporting References and Sections
CWA Section 404	USACE	Coastal Land Use/ Modification, Discharges and Wastes	33 U.S.C. § 1251, OCS Report BOEM 2020-059 (BOEM 2020a)
Marine Plastic Pollution Research and Control Act	USCG	Unintended Releases into the Environment	33 U.S.C. § 1901, OCS Report BOEM 2020-059, 2020 NMFS BiOp (NMFS 2020b) and amended ITS (NMFS 2021a), Appendix B
National Contingency Plan (CWA, Oil Pollution Act, National Oil and Hazardous Substances Pollution Contingency Plan)	USCG; USEPA; State, Regional, and local governments	Unintended Releases into the Environment	40 CFR part 300, Section 311 of the Clean Water Act, Oil Pollution Act of 1990 (33 U.S.C. § 2701), the National Response Framework, Executive Orders 12580 and 12777, Secretarial Order 3299
Marine Debris Research, Prevention, and Reduction Act	USEPA, USCG	Unintended Releases into Environment	33 U.S.C. § 1901, OCS Report BOEM 2020-059, NMFS 2020 BiOp (NMFS 2020b) and amended ITS (NMFS 2021a), Appendix B
Hard Bottom Habitat Avoidance Mitigations	BOEM, BSEE	Bottom Disturbance, Offshore Habitat Modification/Space Use	BOEM NTL No. 2009-G39; BOEM NTL No. 2009-G40; Chapters 6, 7.6, and 7.9 of the GOM Oil and Gas SID
Topographic Features and Live Bottom Stipulations	BOEM, BSEE	Bottom Disturbance, Offshore Habitat Modification/Space Use	Chapters 6, 7.6, and 7.9 of the GOM Oil and Gas SID

[1] Refer to Chapter 6 of the GOM Oil and Gas SID for conditions of approval commonly applied at the post-lease stage.

4.9.2.1 OCS Oil- and Gas-Related Impact-Producing Factors from Routine Activities from Routine Activities

Noise: Sea turtles in the GOM are exposed to several sources of anthropogenic noise with ongoing OCS oil- and gas-related activities including vessel traffic, dredging, pile driving, decommissioning, and geophysical and geological surveys. Noise has the potential to cause both lethal and nonlethal impacts, including behavioral disturbances, interference with communication via acoustic masking, potential hearing impacts, injury, and death. Sea turtles can detect sounds between 100 Hz and 2kHz (BOEM 2021b); however, there is some sensitivity to frequencies as low as 50 Hz, and possibly as low as 30 Hz (Ridgway et al. 1969). This low-frequency hearing overlaps with low-frequency OCS oil- and gas- related noise in the ocean, including vessel traffic, pile driving, and drilling. Little is known about the extent to which sea turtles depend upon their auditory environment (Popper et al. 2014a). Sea turtle responses to low-frequency sounds are expected to include behavior responses, acoustic masking, temporary hearing loss, permanent hearing loss, and mortality (BOEM 2021b). Mounting evidence indicates noise can interfere with communication in sea turtles via acoustic masking (Clark et al. 2009).

Noise associated with OCS oil- and gas-related G&G activities may result in behavioral effects (e.g., changes in direction or swimming speed) or auditory masking in sea turtles. The most likely impacts on sea turtles are expected to be short-term behavioral responses. Studies have demonstrated avoidance behavior of sea turtles to seismic surveys (DeRuiter and Larbi Doukara 2012; Dow Piniak et al. 2012; Lenhardt 1994; McCauley et al. 2000; O'Hara and Wilcox 1990; Suedel et al. 2019). Sea turtles may alter their behaviors when a seismic vessel approaches and thereby suspend feeding, resting, or interacting with conspecifics. Such disruptions are expected to be temporary, however, and are not expected to impact the overall survival and reproduction of individual turtles. Seismic operations have the potential to harm sea turtles in very close proximity to active airgun arrays (Popper et al. 2014a). In addition to noise, the decommissioning of bottom-founded structures through the use of explosive charges generates shock and pressure waves. These shock and pressure waves may cause a number of impacts to sea turtles, including behavioral disturbances, potential hearing impacts, injury, and death (MMS 2005). Chapter 4.6.1 of BOEM's Biological Environmental Background Report (BOEM 2021b) and Chapter 4.3.7.2.2 of the GOM Oil and Gas SID (BOEM 2023e) contain additional information on potential noise impacts from OCS oil- and gas-related activities to sea turtles.

There are several mitigating measures that may reduce the potential impacts of noise to sea turtles. BOEM-permitted activities implement mitigating measures for low-frequency noise (<180 kHz) during G&G survey activity (**Table 4.9-2**). The requirements of the Protected Species Stipulation and 2020 NMFS BiOp, as amended Appendix A, are designed to identify the presence of sea turtles and implement procedures to avoid or reduce sea turtle exposure to seismic sources prior to a survey starting. Similarly, the Protected Species Stipulation and 2020 NMFS BiOp, as amended Appendix I, are designed to identify the presence of sea turtles nearby a structure prior to the detonation of explosives and to avoid or reduce exposure of sea turtles to the shock and pressure waves. These protective measures require the delay explosive detonations if sea turtles are observed within an impact zone, the monitoring after detonations to detect impacted sea turtles (i.e., stunned, injured, or killed), and the collection of injured sea turtles so that aid can be rendered. Detonation delays are also required if *Sargassum* is detected in the impact zone. Additionally, the Pile Driving Monitoring and Reporting Requirements Condition of Approval requires visual monitoring by protected species observers prior to the start of activity, soft starts, and shutdowns in the event a sea turtle is sighted.

Offshore Habitat Modification/Space Use: Leasing on the OCS results in construction and operations activities that occupy OCS space for dedicated uses. Vessel traffic within estuaries could result in habitat loss or degradation and environmental contamination (Robb 2014). Offshore habitat modification could destroy submerged aquatic vegetation habitat that sea turtles depend on for feeding and breeding. These losses would likely be localized, though they could lead to long-term impacts and shoreline loss. In addition, new pipeline landfalls could result in habitat loss or degradation onshore. In the course of construction and operations activities, sea turtles could be exposed to entanglement and entrapment risks from diving activities, site clearance trawling activities, or when moon pools are employed during diving activities or drilling operations. Sea turtle entanglement or entrapment has the potential to cause injury or death. The Protected Species Stipulation; the 2020 NMFS BiOp, as amended Appendix A, Appendix J (Sea Turtle Handling and Resuscitation

Guidelines), the Moon Pool Monitoring COA, and the Slack-line Precautions COA (**Table 4.9-2**) provide guidelines for lines used in the water to prevent looping and tangling, provide response measures if a turtle is injured due to an entanglement, and provide protocols for the use of moon pools to prevent sea turtle entrapment and if entrapped a prompt detection and release. These measures reduce the potential for entanglement and protocols for rendering care if the sea turtle is entangled or entrapped. Chapter 4.6.5 of BOEM's Biological Environmental Background Report (BOEM 2021b) and Chapter 4.3.7.2.2 of the GOM Oil and Gas SID (BOEM 2023e) contain additional information on potential offshore habitat modification/space use impacts from OCS oil- and gas-related activities to sea turtles.

Bottom Disturbance: Most of the GOM seabed is comprised of ubiquitous, soft bottom sediments. In comparison, hard bottom and live bottom habitats have a much more limited distribution. Some sea turtles forage on live bottoms (e.g., sea grass beds). Bottom-disturbing activities can degrade or destroy benthic features used by some sea turtles for foraging and/or habitat. Such activities can result in the loss of foraging grounds and/or preferred habitat. For example, anchors and structure emplacement disturb the seafloor and sediments in the area where they are dropped or emplaced. Further, anchoring can cause physical crushing and compaction beneath the anchor and chains or lines. BOEM-permitted activities implement mitigating measures such as the Topographic Features Stipulation and Live Bottom (Pinnacle Trend) Stipulation to avoid sensitive benthic habitats that may be used by some sea turtles for foraging (**Table 4.9-2**). Therefore, potential impacts from bottom disturbance on the OCS are expected to be limited to soft bottom habitats and distanced from submerged aquatic vegetation habitat that sea turtles may depend on for feeding (refer to **Chapter 4.4** for an analysis of impacts to benthic communities). Drilling impacts would be localized and not expected to occur outside of the immediate area. In addition, infrastructure emplacement, pipeline trenching, and structure removal would be localized and temporary, and habitat loss is not expected.

Lighting and Visual Impacts: Nesting sea turtles and hatchlings are greatly influenced by lighting on nesting beaches. Ports, support facilities, construction facilities, transportation infrastructure, and processing facilities emit light onshore, which could impact sea turtles. Depending on the location of onshore facilities in relation to nesting beaches, lighting could disorient nesting sea turtles and hatchlings. Upon hatching, sea turtles use natural light cues to orient themselves and advance toward the ocean (Witherington and Martin 2003). Additional onshore lighting can confuse hatchling turtles when they emerge from their nests. Artificial light sources (or light pollution) on land might draw hatchlings away from the ocean, resulting in high mortality due to dehydration and predation (Silva et al. 2017; Witherington and Martin 2003). A number of factors can affect light transmission, both in air and water. In air, the transmission of light can be affected by atmospheric moisture levels, cloud cover, and the type and orientation of lights. In water, turbidity levels and waves, as well as the type of light, can affect transmission distance and intensity. Artificial lighting from vessels conducting BOEM-regulated, OCS oil- and gas-related activities would be localized, intermittent, and temporary within any one area.

4.9.2.2 OCS Oil- and Gas-Related Impact-Producing Factors from Accidental Events

Unintended Releases into the Environment: Entanglement in marine debris could lead to injury, infection, reduced mobility, increased susceptibility to predation, decreased feeding ability, fitness consequences, and/or mortality (e.g., drowning) of sea turtles (Gall and Thompson 2015). Marine debris ingestion could lead to intestinal blockage, which can impact feeding ability and lead to injury or death (Senko et al. 2020). Data on marine debris in some locations of the GOM is largely lacking; however, Choi et al. (2021) evaluated plastic ingestion by green sea turtles by synthesizing information from over 33 years along the Texas Coast of stranded and incidentally captured green sea turtles. Smaller turtles ingested more and smaller sizes of plastic debris than larger turtles. Choi et al. (2021) suggested the smaller pelagic-stage sea turtles may be more vulnerable to plastic ingestion due to foraging location and behavior. It still remains difficult to draw conclusions as to the precise extent and origin of anthropogenic marine debris and its impacts on sea turtle populations. Recent studies have identified the potential for microplastics to cause, in addition to physical impacts, metabolic and toxicity impacts on variety of marine organisms including mammals, reptiles, and birds (Parolini et al. 2023). Through gut analysis, microplastic ingestion has been documented in marine turtles (Duncan et al. 2019). The presence of microplastics on nesting beaches may affect sea turtle nesting site by altering the properties of sediment that affect temperature and permeability (Estrella-Jordon et al. 2023). Lessees are required to perform OCS oil- and gas-related activities in accordance with regulatory requirements (**Table 4.9-2**), which would minimize unintended releases of trash and debris by oil and gas operators. Mitigating measures include the Protected Species Stipulation and 2020 NMFS BiOp, as amended Appendix B (Gulf of Mexico Marine Trash and Debris Awareness and Elimination Survey Protocols), which reiterate the prohibition of discharging materials into the marine environment as outlined in the Marine Plastic Pollution Research and Control Act, MARPOL Annex V, and the Marine Debris Research, Prevention and Reduction Act (**Table 4.9-2**).

Oil spills may put sea turtles at risk because of their lack of avoidance behavior, indiscriminate feeding in convergence zones, and large pre-dive inhalations (Shigenaka et al. 2010). Sea turtles accidentally exposed to oil or tarballs may suffer inflammatory dermatitis, ventilatory disturbance, salt gland dysfunction or failure, immune responses, and digestive disorders or blockages (Lutcavage et al. 1995). Contact with hydrocarbons may not cause direct or immediate impacts, but sublethal impacts. Eggs, hatchlings, and small juveniles are particularly vulnerable to contacting or ingesting hydrocarbons due to the convergence of their habitat and areas where oil typically aggregates. Contact in young individuals may bioaccumulate over their lifespan. Bioaccumulation of heavy metals and polycyclic aromatic hydrocarbons (PAHs) have been documented in sea turtles worldwide, and numerous potential exposure pathways for these persistent pollutants have been identified and include pollution and spills (Arienzo 2023). Lessees are required to perform OCS oil- and gas-related activities in accordance with regulatory requirements, such as the National Contingency Plans (**Table 4.9-2**), which provide effective control and containment and would be expected to limit the volume and area of exposure. Chapters 4.6.8.1 and 4.6.8.3 of BOEM's Biological Environmental Background Report (BOEM 2021b) and Chapter 4.3.7.2.3 of the GOM Oil and Gas SID contain additional information on potential impacts from OCS oil- and gas-related unintended releases into the environment to sea turtles.

Response Activities: Spill-response activities may affect sea turtle habitat and temporarily displace sea turtles from suitable habitat. Impact-producing factors might include artificial lighting, machine and human activity, vessel traffic, and changed beach landscapes and composition. Impacts from cleanup could include crushed nests, deterred nesting behavior, and increased mortality of hatchlings (Lutcavage et al. 1997). Due to spill response and cleanup efforts, much of an oil spill may be recovered before it reaches the coast. However, offshore cleanup efforts may result in additional mortality to individuals, particularly neonates and juveniles. Due to the nature of response activities, impacts could occur resulting in behavioral changes of individuals in the immediate area. Through the National Contingency Plan (40 CFR part 300) and the Federal laws that underpin this regulation, response plans at the Federal, State, and local level (e.g., from the USCG, BSEE, States, NMFS, FWS, and NPS) have been developed to detect sea turtles during response activities and implement cleanup strategies that avoid or reduce direct impacts to sea turtles, such as damaging nests or discouraging females from coming onto the beach or altering sea turtle habitat making beach sites no longer suitable for nesting. These plans increase surveillance and the detection of animals, thus reducing potential impacts through avoidance measures (refer to **Table 4.9-2**). Lessees are required to perform OCS oil- and gas-related activities in accordance with regulatory requirements. Chapter 4.6.8.2 of BOEM's Biological Environmental Background Report (BOEM 2021b) and Chapter 4.3.7.2.3 of the GOM Oil and Gas SID (BOEM 2023e) contain additional information on potential impacts from OCS oil- and gas-related response activities to sea turtles.

Strikes and Collisions: Vessel traffic in the GOM is concentrated near major ports, such as Port Fourchon, Louisiana, and Houston, Texas. Vessel strikes are known to result to injury and mortality to sea turtles (Work et al. 2010). Sea turtles are known to bask at the surface of the water and recent studies show that time spent at the surface for basking, feeding, orientation and mating are about 11 percent for loggerhead (Garrison et al. 2020), approximately 19 percent for green sea turtles (Roberts et al. 2022) and between 11 and 23 percent (Garrison et al. 2020) for Kemp's ridley sea turtles, depending on the season. Although sea turtles are able to move somewhat quickly, they are still at risk of being struck by vessels moving rapidly while on the surface. Foley et al. (2019) studied vessel strike injury among stranded (i.e., dead, sick, or injured) sea turtles found in Florida between 1986 and 2014 along the entire Florida coastline. Based on this analysis, the frequency of vessel strike was identified in a third (33%) of the stranded loggerhead, green and leatherback sea turtles and a slightly lower percentage for Kemp's ridley sea turtles (26%) and hawksbill sea turtles (15%). A subset of the dead sea turtles was necropsied and vessel strike injury was identified as the cause or the probable cause of death in over 90 percent of those sea turtles. BOEM permitted activities implement mitigating measures for vessel strikes during activity (refer to **Table 4.9-2**), which would prevent or substantially reduce sea turtle interactions with transiting vessels. The Protected Species Stipulation and 2020 NMFS BiOp, as amended Appendix C (Vessel Strike Avoidance and Injured/Dead Aquatic Protected Species Reporting Protocols) provide requirements for vigilant monitoring for sea turtles during transit and maintaining a separation distance while underway if sea turtles are detected. These requirements reduce the potential for vessel strikes or collisions and require operators to report instances of vessel strikes and collisions. There have been no documented sea turtle collisions with OCS oil- and gas-related vessels in the GOM; however, collisions with small or submerged sea turtles may go undetected. Chapter 4.6.8.4 of BOEM's Biological Environmental

Background Report (BOEM 2021b) and Chapter 4.3.7.2.3 of the GOM Oil and Gas SID contain additional information.

4.9.2.3 Alternatives Analysis

Alternative A – No Action (Cancellation of a Single Proposed OCS Oil and Gas Lease Sale)

Under Alternative A, a proposed OCS oil and gas lease sale would not occur, so there would be no new routine activities or accidental events resulting from the proposed action. Therefore, no direct or indirect impacts to sea turtles would occur as a result of the proposed action (i.e., a proposed oil and gas lease sale) and the impact of Alternative A on sea turtles would be **none**. However, there are ongoing OCS oil- and gas-related activities and other non-OCS oil- and gas-related activities that contribute to the baseline environment (summarized in **Chapter 4.0.1** of this Programmatic EIS with more detail in Chapter 3 of the GOM Oil and Gas SID) that also affect sea turtles and would still occur. Ongoing activities associated with previous OCS oil and gas lease sales (**Table 3.3-2**) could still have potential direct impacts to sea turtles through noise, offshore habitat modification/space use, bottom disturbance, lighting/visual impacts, unintended releases into the environment, response activities, and strikes and collisions. The potential impacts are summarized above in **Chapter 4.9.2.2** and in greater detail in Chapter 4.4.3 of the GOM Oil and Gas SID and evaluated as part of the cumulative analysis in **Chapter 4.17.9**.

Comparison of Impacts under Alternatives B, C, and D

A proposed regionwide OCS oil and gas lease sale under Alternatives B through D, and the resulting OCS oil- and gas-related development on any subsequent leases from the proposed OCS lease sale, could result in noise, offshore habitat modification/space use, bottom disturbance, lighting and visual impacts, unintended releases into the environment, response activities, and strikes and collisions that could potentially impact sea turtles.

Alternative B represents the largest geographic area under consideration for a proposed regionwide OCS oil and gas lease sale. Alternatives C and D represent geographical constraints on available acreage for leasing, which could change the spatial distribution of the scenario activities, but not their overall activity levels. Therefore, this alternatives analysis is focused on the potential environmental impacts of a proposed regionwide OCS oil and gas lease sale (Alternative B) and then considers if these potential impacts could be reduced by the geographic constraint under each alternative considered (Alternatives C and D).

Table 4.9-3 shows the impact determinations for each IPF that affects sea turtles for each action alternative analyzed. Impacts are shown both with and without the mitigating effects of BOEM's protective measure(s) being considered in this Programmatic EIS, if applicable to that IPF. The impacts of Alternative A are not shown in **Table 4.9-3** because an OCS oil and gas lease sale would not occur and the impacts for all IPFs from the proposed action would be **none**.

Table 4.9-3. Impact Determinations for Routine and Accidental Impacts to Sea Turtles for Alternatives B-D.

Impact-Producing Factor	BOEM's Protective Measure(s)[1]	Alternative B	Alternative C	Alternative D
Noise	Without Protective Measures	**Negligible** to **Moderate**	**Negligible** to **Moderate**	**Negligible** to **Moderate**
Noise	With Protective Measures	**Negligible** to **Minor**	**Negligible** to **Minor**	**Negligible** to **Minor**
Offshore Habitat Modification/ Space Use	Without Protective Measures	**Negligible** to **Moderate**	**None** in excluded areas; **Negligible** to **Moderate** in leased areas only	**None** in excluded areas; **Negligible** to **Moderate** in leased areas only
Offshore Habitat Modification/ Space Use	With Protective Measures	**Negligible**	**None** in excluded areas; **Negligible** in leased areas only	**None** in excluded areas; **Negligible** in leased areas only
Bottom Disturbance	Without Protective Measures	**Negligible** to **Minor**	**None** in excluded areas; **Negligible to Minor** in leased areas only	**None** in excluded areas; **Negligible to Minor** in leased areas only
Bottom Disturbance	With Protective Measures	**Negligible**	**None** in excluded areas; **Negligible** in leased areas only	**None** in excluded areas; **Negligible** in leased areas only
Lighting and Visual Impacts	N/A	**Negligible**	**None** in excluded areas; **Negligible** in leased areas only	**None** in excluded areas; **Negligible** in leased areas only
Unintended Releases into the Environment (marine debris)	Without Protective Measures	**Negligible** to **Minor**	**Negligible** to **Minor**	**Negligible** to **Minor**
Unintended Releases into the Environment (marine debris)	With Protective Measures	**Negligible**	**Negligible**	**Negligible**
Unintended Releases into the Environment (oil spills)	N/A	**Negligible** to **Minor**	**Negligible** to **Minor**	**Negligible** to **Minor**
Response Activities	N/A	**Negligible** to **Minor**	**Negligible** to **Minor**	**Negligible** to **Minor**
Strikes and Collisions	Without Protective Measures	**Negligible** to **Moderate**	**Negligible** to **Moderate**	**Negligible** to **Moderate**
Strikes and Collisions	With Protective Measures	**Negligible** to **Minor**	**Negligible** to **Minor**	**Negligible** to **Minor**

Note: Alternative A is not shown in the table because the impacts from all impact-producing factors is **none**.

[1] Protective measures for application at the OCS lease sale stage are being contemplated in this Programmatic EIS. Additional BOEM protective measures for sea turtles would be considered at the site-specific stage in compliance with existing and future regulatory and consultation requirements.

Alternative B – Regionwide OCS Lease Sale

Alternative B considers a proposed regionwide OCS oil and gas lease sale area. Within this geographic area, impacts may affect all five species of sea turtles found in the GOM. While estuarine and coastal areas are not included in the proposed lease sale area, impacts from the proposed action may extend to coastal areas due to vessel transit, onshore support, and accidental releases potentially reaching inland waters and beaches. The majority of the EPA is excluded from leasing under this alternative (as well as Alternatives C and D), which greatly reduces or eliminates potential impacts to sea turtles and their habitat in the northeastern GOM (i.e., along the Florida coast). Whole and partial blocks within the boundaries of the FGBNMS as of the July 2008 Memorandum on Withdrawal of Certain Areas of U.S. OCS from Leasing Disposition would also be excluded from leasing under this alternative (as well as Alternatives C and D), which would reduce potential impacts to sea turtle habitat and sea turtles themselves when within those blocks.

Noise: Noise can result from any routine OCS oil- and gas-related activity listed in **Table 3.3-2**. Within this geographic area, impacts from noise, including the impacts of shock and pressure waves, would affect sea turtles in a number of ways including behavioral disturbances, interference with communication via acoustic masking, potential hearing impacts, injury, and death. The level of impact is dependent on a variety of factors, including the sound source type, distance from the source, and hearing sensitivity. Sea turtles have been shown to respond to low-frequency sounds; however, noise is not likely to measurably disrupt normal behavior patterns essential to their survival, including breeding and feeding. For impacts to occur, the individual must be within close vicinity of the sound source. Individuals near a sound source may be exposed to intense noises or shock and pressure waves and be injured, and the injury may be irreversible. Given the level of the activities described in **Table 3.3-2** for a single proposed OCS oil and gas lease sale to occur over a 40-year lifespan, the impact of noise to sea turtles is **negligible** to **moderate** when mitigating measures are not applied since sea turtles would not be observed during OCS oil- and gas-related activities and could be exposed to noise at levels that could cause lethal or nonlethal injury. The impacts from noise are expected to be **negligible** to **minor** when mitigating measures are utilized. Applicable mitigating measures (refer to **Table 4.9-2**), such as the Protected Species Stipulation; the Pile Driving Monitoring and Reporting COA; and the 2020 NMFS BiOp, as amended, Appendices A and I identify the presence of sea turtles, implement procedures to avoid or reduce sea turtle exposure to seismic sources prior to a survey starting, require the delay of explosive detonations if sea turtles and/or *Sargassum* (juvenile sea turtle habitat) are observed within an impact zone, and require collection of injured sea turtles so that aid can be rendered. With the application of these protective measures, it is expected that impacts would not be at levels that would affect the fitness of any population.

Offshore Habitat Modification/Space Use: Offshore habitat modification/space use could occur from any routine OCS oil- and gas-related activity except for G&G survey activity, service vessel trips, and helicopter operations (**Table 3.3-4**). The number of projected installed production structures would be less than the number of projected to be removed (**Table 3.3-2**) and 0-1 pipeline landfalls are expected from a single oil and gas lease sale. Given the level of routine OCS oil- and gas-related activities that could lead to offshore habitat modification/space use described in **Table 3.3-2** for a single proposed OCS oil and gas lease sale to occur over a 40-year lifespan, impacts to sea turtles could occur in the vicinity of routine OCS oil- and gas-related construction, operation, and decommissioning activities. Offshore habitat modification/space use has the potential to cause behavioral effects, decreased feeding ability, reduced mobility, stress, injury, or death. The impacts are expected to be **negligible** to **moderate** when mitigating measures (**Table 4.9-2**) are not used because although effects will be localized, entanglement in lines or trawl nets may result in death of individual sea turtles. Impacts from offshore habitat modification/space use are expected to be **negligible** when mitigating measures are utilized because the application of the Protected Species Stipulation; the 2020 NMFS BiOp, as amended Appendices A and J; the Moon Pool Monitoring COA; and the Slack-line Precautions COA provide guidelines for lines used in the water to prevent looping and tangling, provide response measures if a turtle is injured due to an entanglement, and provide protocols for the use of moon pools to prevent sea turtle entrapment and if entrapped a prompt detection and release. These measures reduce the potential for entanglement and protocols for rendering care if the sea turtle is entangled or entrapped. With the application of these protective measures, effects from a single proposed OCS oil and gas lease sale are not anticipated to produce population-level impacts on sea turtles in the GOM.

Bottom Disturbance: Bottom disturbance can occur from any routine OCS oil- and gas-related activity, except for service-vessel trips and helicopter operations (**Table 3.3-4**). Given the level of these activities described in **Table 3.3-2** for a single proposed OCS oil and gas lease sale to occur over a 40-year lifespan, impacts to sea turtles in the vicinity of bottom-disturbing activities, such as drilling, are expected to be relatively undetectable. Bottom disturbance could affect sea turtles in the vicinity of bottom-disturbing activities, such as drilling, installation and removal of infrastructure, and anchoring. Bottom disturbance has the potential to displace some sea turtles from foraging grounds and/or preferred habitat, and impacts are expected to be **negligible** to **minor** when mitigating measures are not used since some sea turtles would experience reduced foraging and/or preferred habitat in a specific temporarily disturbed area. The impact is expected to be **negligible** when mitigating measures are used because there would be no detectable impacts on sea turtles. Applicable mitigating measures, such as the Topographic Features Stipulation and Live Bottom (Pinnacle Trend) Stipulation (refer to **Table 4.9-2**) would prevent or substantially reduce sea turtle interactions with bottom-disturbing activities by requiring avoidance distances from sensitive benthos that some sea turtles may use for foraging and/or as habitat.

Lighting and Visual Impacts: Within this geographic area, impacts from lighting and visual impacts from onshore support infrastructure have the potential to disorient adult sea turtles as they move onshore to nest or hatchlings as they emerge from their nests and move offshore. Lighting on OCS offshore facilities is not expected to impact juvenile or adult sea turtles in open water and due to the structures' distance from beaches is not expected to impact nesting adults or hatchings on land. The contribution of lighting from new onshore oil and gas infrastructure resulting from the proposed action compared to the background level of lighting is expected to be low. New industrial construction is expected to occur within already industrialized areas and is likely to be distanced from nesting beaches. While sea turtle lighting protections are regulated in Florida through Florida Administrative Code 62B-55, other Gulf Coast States do not have statewide lighting codes designed to protect nesting adult sea turtles or hatchling. As a result, sea turtles that nest and hatch in the other Gulf Coast States located adjacent to the geographic area of Alternative B would not universally have the protection of lighting ordinances for sea turtle protection. However, given the level of routine OCS oil- and gas-related activities that could lead to lighting and visual impacts described in **Table 3.3-2** for a single proposed OCS oil and gas lease sale to occur over a 40-year lifespan, impacts to sea turtles are expected to be **negligible**.

Unintended Releases into the Environment: Within this geographic area, impacts from unintended releases into the environment could lead to injury, infection, reduced mobility, increased susceptibility to predation, decreased feeding ability, fitness consequences, and/or mortality (e.g., drowning) of sea turtles from entanglement. Marine debris ingestion could lead to intestinal blockage, which can impact feeding ability and lead to injury or death. Unintended releases into the environment from accidental marine debris can occur from any routine OCS oil- and gas-related activity (**Table 3.3-4**). Given the level of these activities described in **Table 3.3-2** for a single proposed OCS oil and gas lease sale to occur over a 40-year lifespan, impacts to sea turtles could occur in the immediate vicinity of the accidental marine debris. The impacts from the accidental releases of trash and debris are expected to be **negligible** to **minor** when mitigating measures (**Table 4.9-2**) are not utilized because the amount of debris from a single oil and gas lease sale would be largely undetectable and highly localized. The impacts from accidental releases of trash and debris are expected to be **negligible** when mitigating measures (**Table 4.9-2**) are utilized because the Protected Species Stipulation and 2020 NMFS BiOp, as amended Appendix B, reiterate the prohibition of discharging materials into the marine environment as outlined in the Marine Plastic Pollution Research and Control Act, MARPOL Annex V, and the Marine Debris Research, Prevention and Reduction Act, which could reduce the amount of trash and debris in the marine environment. Additionally, localized impacts of trash and debris are not expected to result in population-level impacts to the species.

Unintended releases into the environment from oil spills can occur from any routine OCS oil- and gas-related activity (**Table 3.3-4**). The effects of a spill would depend on the volume of the spill and time before it is actively removed as part of a spill response or naturally weathers (refer to **Chapter 3.5.1.1**). Small spills, though relatively common, dissipate quickly and have limited, localized impacts. However, a limited number of large spills are expected to occur as a result of the proposed action. Although spills with volumes >10,000 bbl are uncommon, they can occur, and one did occur in the GOM in the past year (refer to **Chapter 3.5.1.1**). There have been no reported impacts to wildlife. Spills >10,000 bbl may affect sea turtles because a greater volume of spilled oil would be expected to also affect a larger area of surface waters, into which a sea turtle could surface. The effects of contact with spilled oil on individual sea turtles could include mortality; decreased health, reproductive fitness, and longevity; as well as increased vulnerability to disease and contamination of prey species. If contact were made, population-level effects are unlikely given sea turtles' large range and general trends of increasing populations. Lessees are required to perform OCS oil- and gas-related activities in accordance with regulatory requirements, such as the National Contingency Plans (**Table 4.9-2**), which provide effective control and containment and would be expected to limit the volume and area of exposure. Therefore, impacts from accidental oil spills would be **negligible** to **moderate** depending on the spill size and location.

Response Activities: Response activities can occur from any routine OCS oil- and gas-related activities except for helicopter operations (**Table 3.3-4**). Given the scale and effects of response activities would depend on the volume of the spill (**Chapter 3.5.1.1**), impacts to sea turtles could occur in the vicinity of spill-response activities on the OCS. Impacts from response activities may result in behavioral responses, injury, or mortality through vessel strike, entanglement, chemical inhalation, and disturbance to beach nesting habitats. Exposure to response activities may result in potential changes in behavior and/or distribution, thereby potentially stressing sea turtles and perhaps making them more vulnerable to various physiologic and toxic effects of spilled oil. Through the National Contingency Plan (40 CFR part 300) and the Federal laws that underpin this regulation, response plans at the Federal, State, and local level have been developed to reduce potential impacts through avoidance measures (**Table 4.9-2**). Thus, given the likely non-catastrophic spill size, if it were to occur (**Chapter 3**; Ji and Schiff 2023), subsequent response activities expected to occur in a limited area, the wide-ranging movements and distribution of sea turtles, and the spill response plans and safety protocols (e.g., National Contingency Plans) that lessees must abide by when conducting OCS oil- and gas-related activities (**Table 4.9-2**), the impacts of response activities are expected to be **negligible** to **minor**. In addition, response activities for a single OCS oil and gas lease sale are likely to be localized and limited to effects on the individual and not the population.

Strikes and Collisions: Accidental strikes and collisions can occur from the routine OCS oil- and gas-related activity of G&G survey activity, production structures removed using explosives, other structure removal, service-vessel trips, and helicopter operations (**Table 3.3-4**). Given the level of this activity described in **Table 3.3-2** for a single proposed OCS oil and gas lease sale to occur over a 40-year lifespan, impacts to sea turtles could occur in the immediate vicinity of transiting vessels. The impacts of strikes and collisions could include injury or mortality of sea turtles. The percentage of vessel traffic in the GOM that can be attributed to OCS oil- and gas-related activities is relatively low compared to all other vessel traffic in the GOM (**Table 3.3-2**), and the portion of time sea turtles spend at the surface is also documented to be low (up to 23% of the time). The number of additional service-vessel trips from a single oil and gas lease sale account for a fraction of cumulative service-vessel trips (**Table 3.3-2**). Thus, the impacts of a single proposed OCS oil and gas lease sale are not expected to produce population-level impacts to sea turtles and is expected to be **negligible** to **moderate** when mitigating measures (**Table 4.9-2**) are not used since sea turtles would be more vulnerable to vessel strikes without speed restrictions, separation distances, and the use of protected species observers, causing injury or death. The impact of vessel strikes and collisions on sea turtles is **negligible** to **minor** when mitigating measures are utilized. The Protected Species Stipulation and 2020 NMFS BiOp, as amended Appendix C provide requirements for vigilant monitoring for sea turtles during transit and maintaining a separation distance while underway if sea turtles are detected (**Table 4.9-2**). These requirements reduce the potential for vessel strikes or collisions and require operators to report instances of vessel strikes and collisions. To date, no incidents have been reported throughout the duration of the long-standing program.

Therefore, based on the description of the IPFs above and the scenario projections for a single proposed OCS oil and gas lease sale provided in **Chapter 3**, the overall impacts from IPFs associated with Alternatives B on sea turtles would be **negligible** to **moderate** without applicable measures in place to protect sea turtles from harmful levels of noise; slack-lines in the water; bottom disturbance; accidental marine debris entanglement, entrapment, or ingestion; accidental vessel strikes; accidental oil-spill contact; and spill-response activities. When mitigating measures, including the Topographic Features and Live Bottom (Pinnacle Trend) Stipulations; NTL No. 2009-G39; Protected Species Stipulation; Pile Driving Monitoring and Reporting Requirements COA; in addition to 2020 NMFS BiOp, as amended; Moon Pool Monitoring COA; the Slack-line Precautions COA; Reporting Requirements COA; and Appendices A, B, C, I, and J are utilized, impacts would be **negligible** to **minor** because exposures to the IPFs would be substantially reduced or avoided, thereby substantially reducing or eliminating IPF impacts to sea turtles.

Alternative C – Inflation Reduction Act Targeted OCS Lease Sale Area

Alternative C represents a geographical constraint on available acreage for leasing, which would cause a change in the spatial distribution of most activities compared to Alternative B but not the types of activities or their levels. Most impacts to sea turtles from routine OCS oil- and gas-related activities are not expected to occur in areas removed from potential leasing under Alternative C because, as discussed under Alternative B, areas of impacts from routine OCS oil- and gas-related activities occur within limited areas surrounding activity and these activities would not occur in excluded areas. Impacts from most routine activities would be limited to the areas leased under this alternative. One exception is noise, which could potentially travel from the sound source into excluded areas, resulting in impacts to sea turtles. The impacts from accidental events would be the same as described for Alternative B, including strikes from vessel traffic, which can occur throughout the GOM from port to lease activity. This is because navigation transit routes are not restricted in the exclusion areas. In addition, oil spills and response activities could occur in the excluded areas. This potential spatial redistribution of activity does not affect impact levels for sea turtles because they are widely distributed throughout the GOM.

While the overall impact levels for routine activities would not differ from Alternative B, the impacts to sea turtles could be reduced in and near the exclusion areas. Some benefits to breeding, nesting, and hatchling sea turtles may also be realized for those individuals that nest and hatch off Baldwin County, Alabama, and the Texas coast shoreward of the identified wind energy areas. Removal of these areas from leasing under this alternative would prevent the installation of new infrastructure in these areas. As a result, the sea turtles moving onshore to nest or offshore after hatching in these areas could have a lower level of exposure to IPFs associated with the installation, operation, maintenance, and decommissioning of offshore OCS oil- and gas-related infrastructure. The exclusion of whole and partial blocks identified as Significant Sediment Resource Areas located along the Texas, Louisiana, and Mississippi coastlines could benefit Kemp’s ridley sea turtles. Kemp’s ridley sea turtles utilize the northern Gulf of Mexico and in particular areas shoreward of the 100-m (328-ft) isobath extending from Texas to the Florida Keys for dispersal and foraging (Gredzens and Shaver 2020). The benefits of Alternative C would be mostly limited to exclusion areas, where routine OCS oil- and gas-related activities would not occur, and areas nearby. Although the exclusion areas would cause a spatial redistribution of OCS oil- and gas-related activities, the impact levels to sea turtles under Alternative C would be the same as under Alternative B because of the sea turtles’ wide distribution and broad use of the GOM.

Therefore, based on the description of the IPFs above and the scenario projections for a single proposed OCS oil and gas lease sale provided in **Chapter 3**, the overall impacts from IPFs associated with Alternatives C on sea turtles would be **negligible** to **moderate** in the leased areas if applicable measures are not in place to mitigate IPF impacts (e.g., vessel strike, noise injury, entanglement in lines, bottom disturbance; accidental oil-spill contact, spill remediation interactions, or accidental marine debris entanglement, entrapment, or ingestion) to sea turtles. When mitigating measures, including the Topographic Features and Live Bottom (Pinnacle Trend) Stipulations; NTL No. 2009-G39; Protected Species Stipulation; Pile Driving Monitoring and Reporting Requirements COA; and 2020 NMFS BiOp, as amended Appendices A, B, C, I, and J; the Moon Pool Monitoring COA; the Slack-line Precautions COA; and Reporting Requirements COA are utilized, this impact would be **negligible** to **minor** in leased areas because exposures to the IPFs would be substantially reduced or avoided, thereby reducing or eliminating IPF impacts to marine mammals.

Alternative D – Targeted OCS Lease Sale Area with Additional Exclusions

Alternative D represents a further geographical constraint on available acreage for leasing, which would cause a change in the spatial distribution of most activities compared to Alternatives B and C but not their overall activity levels. Most impacts to sea turtles from routine OCS oil- and gas-related activities are not expected to occur in areas removed from potential leasing under Alternative D because, as discussed under Alternative B, areas of impacts from routine OCS oil- and gas-related activities occur within limited areas surrounding activity and these activities would not occur in excluded areas. Impacts from most routine activities would be limited to the areas leased under this alternative. One exception is noise, which could potentially travel from the sound source into excluded areas, resulting in impacts to sea turtles. The impacts from accidental events would be the same as described for Alternative B, including strikes from vessel traffic, which can occur throughout the GOM. In addition, oil spills and response activities could occur in the excluded areas. This potential spatial redistribution of activity does not affect impact levels for sea turtles because they are widely distributed throughout the GOM.

While the overall impact levels for routine activities would not differ from Alternative B, the reduced impacts to sea turtles in and near the areas excluded under Alternative C all still apply for Alternative D. Alternative D also excludes coastal areas shoreward of the 20-m (66-ft) isobath along the central and western Louisiana and eastern Texas coasts providing additional benefits to Kemp's ridley sea turtles and other species that utilize these areas for foraging since the exclusion prevents the development of additional infrastructure in these areas. Further protection is provided with the exclusion of the Gulf of Mexico Wind Leasing Call Area because routine OCS oil- and gas-related activities would not occur in the areas excluded under Alternative D, and sea turtles foraging and resting within those areas would not experience impacts from routine OCS oil- and gas-related activities. The impacts from accidental events would be the same as described for Alternative B, including strikes from vessel traffic, which can occur throughout the GOM from port to lease activity. Navigation transit routes are not restricted in the exclusion areas; therefore, navigation traffic and the potential for vessel strike could still occur in the exclusion areas. In addition, oil spills and response activities could occur in the excluded areas. The benefits of Alternative D would be mostly limited to exclusion areas, where routine OCS oil- and gas-related activities would not occur, and areas nearby. Although the exclusion areas would cause a spatial redistribution of OCS oil- and gas-related activities, the impact levels to sea turtles under Alternative D would be the same as under Alternative B because of sea turtles' wide distribution and broad use of the GOM.

Therefore, based on the description of the IPFs above and the scenario projections for a single proposed OCS oil and gas lease sale provided in **Chapter 3**, the overall impacts from IPFs associated with Alternatives D on sea turtles would be **negligible** to **moderate** in the leased areas if applicable measures are not in place to mitigate IPF impacts (e.g., vessel strike, noise injury, entanglement in lines, bottom disturbance, accidental oil-spill contact, spill remediation interactions, or accidental marine debris entanglement, entrapment, or ingestion) to sea turtles. When mitigating measures, including the Topographic Features and Live Bottom (Pinnacle Trend) Stipulations; NTL No. 2009-G39; Protected Species Stipulation; Pile Driving Monitoring and Reporting Requirements COA; and 2020 NMFS BiOp, as amended Appendices A, B, C, I, and J; the Moon Pool Monitoring COA; the Slack-line Precautions COA; and Reporting Requirements COA are utilized, this impact would be **negligible** to **minor** in leased areas because exposures to the IPFs would be substantially reduced or avoided, thereby substantially reducing or eliminating IPF impacts to marine mammals**.**

4.9.3 Incomplete or Unavailable Information

BOEM has identified incomplete or unavailable information that may be relevant to reasonably foreseeable impacts on sea turtles. Such information includes impacts from noise, climate change, disease, marine trash and debris, and oil spills and spill-response activities on sea turtles in the GOM, which can be difficult to quantify. The future rates of sea-level rise, beach erosion, and nest sex ratios as a result of climate change are unknown, and so future impacts to the GOM are unknown beyond predictions developed by models and short-term trends. BOEM has determined that such information is not essential to a reasoned choice among alternatives because none of the available scientific publications reveal reasonably foreseeable significant adverse impacts to sea turtles not otherwise considered in this Programmatic EIS. BOEM's subject-matter experts have used publicly available scientifically credible evidence presented herein and applied accepted scientific methodologies to integrate existing information qualitatively and quantitatively (if available) and extrapolated potential outcomes in completing this analysis and formulating the conclusions. Therefore, the incomplete or unavailable information, while relevant, would not likely change the impact conclusions reached in this analysis and is not essential to a reasoned choice among alternatives.

4.10 Commercial Fisheries

Commercial fisheries are an important industry and economic driver in the Gulf of Mexico. Some of the most economically important commercial fisheries in the Gulf of Mexico are white shrimp (*Litopenaeus setiferus*), brown shrimp (*Farfantepenaeus aztecus*), eastern oysters (*Crassostrea virginica*), Gulf menhaden (*Brevoortia patronus*), blue crab (*Callinectes sapidus*), red grouper (*Epinephelus morio*), red snapper (*Lutjanus campechanus*), and tunas (*Thunnus* spp.). Commercial fisheries are managed by NOAA Fisheries (NMFS), as advised by the Regional Fisheries Management Councils. The NOAA Fisheries reports each year to Congress and the Fishery Management Councils on the status of all fish stocks in the Nation. Commercial fisheries are regulated by various mechanisms, including permitting, closures, quotas, and gear restrictions; details regarding these mechanisms are described by the Gulf of Mexico Fishery Management Council (2024). This source also describes the allowable gear types for each fishery. Some of the most common gear types are trawls (for shrimp), purse seines (for menhaden), dredges (for oysters), traps (for blue crab), and longlines (for various finfish).

4.10.1 Affected Environment

The biological aspects of the affected environment for the targeted species are discussed in **Chapter 4.6.1** and habitats are discussed in **Chapters 4.3.1**, **4.4.1, and 4.5.1**. For more information on commercial fisheries of the GOM, refer to Chapter 4.2.2 of the GOM Oil and Gas SID (BOEM 2023e).

Landings Revenues

The Gulf of Mexico is home to a large and complex commercial fishing industry. There were $891.2 million in total landings in the GOM in 2022, which comprised 16 percent of total U.S. landings (NMFS 2022a). Panel A of **Table 4.10-1** presents the total landings revenues for key GOM fisheries, while Panels B through F present the landings revenues for the key fisheries in each Gulf Coast State from 2019 through 2022. There were $891.2 million in landings revenues in 2022, compared with $816 million in 2019, $755.3 million in 2020, and $920.1 million in 2021. Fisheries landed offshore of Louisiana accounted for the most fisheries revenue in 2022, followed (in descending order) by West Florida, Texas, Alabama, and Mississippi. Shrimp species (particularly white shrimp and brown shrimp) account for the most landings revenues ($342,314,000 in 2022) in the Gulf of Mexico. Shrimp are caught offshore of all states, particularly Texas and Louisiana, in Federal and State waters. Menhaden accounts for the most pounds (1,053,564,062 pounds in 2022) landed in the GOM (NMFS 2022a; 2023c). However, because the average price per pound of menhaden is much lower than for other species, menhaden landings accounted for the second most landings revenue ($150,774,000) in 2022. Menhaden is primarily caught in State and Federal waters offshore of Louisiana and Mississippi. Blue crab ($102,363,000) and oysters ($93,010,000) accounted for the third and fourth highest landings revenues in 2022. These species are caught in State waters of all Gulf Coast States. Red snapper and tunas are primarily caught in Federal waters offshore various states. Stone crab (*Menippe mercenaria*) and Caribbean spiny lobster (*Panulirus argus*) are primarily caught offshore Florida.

Table 4.10-1. Landings Revenue by Species and State (in thousands of dollars).

Panel	Species	2019	2020	2021	2022
Panel A: Gulfwide	Shrimp	371,027	350,013	442,620	342,314
Panel A: Gulfwide	Menhaden	102,448	105,097	81,751	150,774
Panel A: Gulfwide	Oysters	87,929	62,247	91,105	93,010
Panel A: Gulfwide	Blue crab	69,605	78,929	107,840	102,363
Panel A: Gulfwide	Spiny lobster	30,045	22,149	37,873	39,912

Panel	Species	2019	2020	2021	2022
Panel A: Gulfwide	Groupers	21,044	4,823	5,153	3,650
Panel A: Gulfwide	Red snapper	32,161	31,005	32,383	34,476
Panel A: Gulfwide	Crawfish	13,169	11,487	14,300	13,870
Panel A: Gulfwide	Mullets	5,229	4,169	5,041	5,810
Panel A: Gulfwide	Tunas	2,466	1,760	1,693	1,314
Panel A: Gulfwide	Total Revenue	816,050	755,359	920,087	891,243
Panel B: Louisiana	Shrimp	120,385	98,952	130,619	115,470
Panel B: Louisiana	Menhaden	60,347	66,442	60,396	107,078
Panel B: Louisiana	Oysters	50,134	26,967	53,054	75,281
Panel B: Louisiana	Blue crab	52,232	63,484	92,292	87,174
Panel B: Louisiana	Crawfish	13,169	11,487	14,300	13,870
Panel B: Louisiana	Red snapper	5,445	4,695	5,299	5,607
Panel B: Louisiana	Tunas	1,813	1,216	1,017	4
Panel B: Louisiana	King mackerel	2,427	1,602	771	615
Panel B: Louisiana	Vermillion snapper	581	261	287	401
Panel B: Louisiana	Mullets	132	3	2	338
Panel B: Louisiana	Total Revenue	317,319	283,823	367,125	416,484
Panel C: Texas	Shrimp	151,041	142,954	183,629	132,389
Panel C: Texas	Oysters	33,496	30,626	31,213	11,847
Panel C: Texas	Red snapper	12,548	12,176	12,647	14,376
Panel C: Texas	Blue crab	5,529	5,028	5,156	4,961
Panel C: Texas	Black drum	2,288	1,471	1,622	1,892
Panel C: Texas	Groupers	1,302	542	549	450
Panel C: Texas	Vermillion snapper	323	276	179	332
Panel C: Texas	Flounders	107	112	68	94
Panel C: Texas	Atlantic croaker	1320	1,343	1,099	869
Panel C: Texas	Total Revenue	209,279	195,628	237,233	168,446
Panel D: West Florida	Shrimp	34,454	42,690	53,175	46,958
Panel D: West Florida	Lobsters	30,053	53,418	44,056	39,371
Panel D: West Florida	Stone crab	33,957	27,911	35,758	28,106
Panel D: West Florida	Red grouper	10,691	21,217	18,931	17,836
Panel D: West Florida	Red snapper	11,751	8,111	9,997	8,599
Panel D: West Florida	Mullets	4,209	9,387	6,148	6,336
Panel D: West Florida	Blue crab	9,748	7,385	8,487	6,127
Panel D: West Florida	Gag grouper	3,205	2,889	2,782	4,659
Panel D: West Florida	Oyster	2,756	4,178	4,722	4,266
Panel D: West Florida	Total Revenue	173,129	155,538	198,466	188,467
Panel E: Mississippi	Shrimp	15,128	13,012	12,282	9,567

Panel	Species	2019	2020	2021	2022
Panel E: Mississippi	Menhaden	41,992	38,527	21,054	43,422
Panel E: Mississippi	Blue crab	692	1,340	1,635	1,495
Panel E: Mississippi	Mullets	18	12	15	14
Panel E: Mississippi	Red snapper	155	393	307	221
Panel E: Mississippi	Total Revenue	58,661	53,550	35,561	55,173
Panel F: Alabama	Shrimp	50,020	60,055	71,060	52,830
Panel F: Alabama	Blue crab	1,404	901	1,143	1,188
Panel F: Alabama	Red snapper	2024	1,511	1,175	661
Panel F: Alabama	Spanish mackerel	577	288	250	330
Panel F: Alabama	Oysters	1543	2,426	5,238	4,360
Panel F: Alabama	Mullets	392	344	1,222	1,300
Panel F: Alabama	Total Revenue	57,662	66,821	81,703	62,673

Source: NMFS (2023d).

Fisheries Supply Chain

The fisheries landings discussed above are brought to shore at various ports along the Gulf Coast. Some of the leading commercial fishing ports, along with the fisheries revenues received in 2022 at these ports, are Empire-Venice, Louisiana ($163.3 million); Bayou La Batre, Alabama ($59.5 million); Dulac-Chauvin, Louisiana ($59.4 million); Galveston, Texas ($43.8 million); Port Arthur, Texas ($40.4 million); Brownsville-Port Isabel, Texas ($32 million); and Intracoastal City, Louisiana ($24.9 million) (NMFS 2023b). Fish landings then proceed through supply chains that include dealers, processors, distributors, markets, and restaurants. The NMFS used economic modeling techniques to estimate the supply chain impacts of fisheries landings (NMFS 2022b). The NMFS' estimates of the number of jobs and the amount of value-added (the economic contribution beyond the initial landed catch, including processing, distribution, and marketing) supported by fisheries landings in each Gulf Coast State are listed below in **Table 4.10-2**. The large impacts in Florida are due to its high numbers of seafood importers, wholesalers, distributors, and retailers.

Table 4.10-2. Estimated Number of Jobs and Value-Added to the Gulf of Mexico States by Commercial Fisheries in 2019.

State	Number of Jobs	Value-Added
Texas	35,517	$4,900,200,000
Louisiana	22,371	$1,353,405,000
Florida	76,685	$18,501,239,000
Alabama	11,475	$560,378,000
Mississippi	6,459	$346,873,000

Note: The information for Florida is for the entire state.
Source: NMFS (2022b).

COVID-19 Pandemic

Since the onset of COVID-19 in early 2020, the pandemic has persistently affected fisheries in the GOM. The adverse consequences include complete shutdowns of certain fisheries, market disruptions, heightened health risks for fishers, and additional implications for marginalized communities (Bennett et al. 2020; Peters 2020). The Coronavirus Aid Relief and Economic Security Act earmarked $300 million in relief funds for fisheries and aquaculture (NMFS 2020c). An additional allocation of $255 million in fisheries assistance funding was provided by the Consolidated Appropriations Act of 2021 to states with coastal and marine fishery participants who have been negatively affected by COVID-19 (NMFS 2021c). The Gulf States Marine Fisheries Commission, in coordination with NOAA Fisheries, is working to distribute the funds in the GOM region (Gulf States Marine Fisheries Commission 2021). BOEM undertook a comparative analysis of NMFS (2023d) landing data in the GOM, examining distinct periods, i.e., pre-Covid-19, Covid-19, and post-Covid. The average of 2017, 2018, and 2019 data served as the pre-Covid-19 baseline, while the average of 2020 and 2021 data represented the Covid year (spanning 2020 and 2021). Additionally, the 2022 data reflected the post-Covid period. Notably, during the Covid year, there was a significant 19 percent reduction in landings—from 658,958 metric tons to 535,700 metric tons. However, the industry rebounded, and landings subsequently increased to 626,511 metric tons in 2022.

4.10.2 Environmental Consequences

Commercial fisheries in the GOM are affected by existing environmental conditions, natural processes and phenomena, and human-induced factors. There are several OCS oil- and gas-related activities and non-OCS oil- and gas-related activities that have the potential to impact commercial fisheries (**Table 4.10-3**). BOEM conducted an initial screening of IPFs in the GOM Oil and Gas SID and determined that bottom disturbance, noise, coastal land use/modification, lighting and visual impacts, offshore habitat modification/space use, socioeconomic changes and drivers, unintended releases into the environment, response activities, strikes and collisions, climate change, and natural processes (e.g., major storm events) could potentially impact commercial fisheries. These IPFs and their potential to affect commercial fisheries are discussed below and in greater detail in Chapter 4.4.2 of the GOM Oil and Gas SID. Supporting rationale for IPFs that were not analyzed in detail in this Programmatic EIS can also be found in Chapter 4.4.2 of the GOM Oil and Gas SID. New information released since the development of the GOM Oil and Gas SID and relevant to the analysis is included in the applicable chapters below.

Table 4.10-3. Impact-Producing Factors with the Potential to Impact Commercial Fisheries.

OCS Oil- and Gas-Related Routine Activities	OCS Oil- and Gas-Related Accidental Events	Non-OCS Oil- and Gas-Related Activities
Noise	Strikes and Collisions	Air Emissions and Pollution
Socioeconomic Changes and Drivers	Unintended Releases into the Environment	Noise
Bottom Disturbance	Response Activities	Socioeconomic Changes and Drivers
Coastal Land Use/ Modification	-	Discharges and Wastes
Lighting and Visual Impacts	-	Bottom Disturbance

OCS Oil- and Gas-Related Routine Activities	OCS Oil- and Gas-Related Accidental Events	Non-OCS Oil- and Gas-Related Activities
Offshore Habitat Modification/ Space Use	-	Coastal Land Use/Modification
-	-	Lighting and Visual Impacts
-	-	Offshore Habitat Modification/ Space Use
-	-	Climate Change

There are several existing regulatory programs and requirements that reduce or minimize the effects of these IPFs to commercial fisheries in the GOM (**Table 4.10-4**) and are enforced by BOEM, BSEE, and other agencies. The *Gulf of Mexico OCS Regulatory Framework* technical report (BOEM 2020a) overviews the complex interconnected regulatory regime that exists around OCS oil- and gas-related activities in the GOM. Lessees are required to perform OCS oil- and gas-related activities in accordance with all regulatory requirements; therefore, the analysis factors in the mitigating effects of all applicable regulatory requirements as part of the proposed action when making impact determinations.

Table 4.10-4. Existing Regulatory Requirements and Protective Measures That Reduce Potential Impacts of Impact-Producing Factors.

Regulatory Requirement or Protective Measure	Enforcing Agency	Impact-Producing Factors(s) Reduced/Avoided	Supporting References and Sections
Marine Plastic Pollution Research and Control Act of 1987	USCG	Unintended Releases into the Environment (marine trash and debris)	Chapters 2.9.1.7 and 4.4.5.2.3 of the GOM Oil and Gas SID
National Fishing Enhancement Act of 1984 (Rigs-to-Reefs)	Secretary of Commerce; BSEE; State agencies	Bottom Disturbance; Offshore Habitat Modification/Space Use	Chapters 2.3.2.4 and 5.3 of the GOM Oil and Gas SID
Fishermen’s Contingency Fund	Financial Services Division of NMFS	Offshore Habitat Modification/Space Use; Accidental Events (compensates commercial fishermen for damages or loss of fishing gear related to oil and gas exploration, development, or production on the OCS)	50 CFR part 296; OCS Report BOEM 2020-059
Hard Bottom Habitat Avoidance Mitigations	BOEM; BSEE	Bottom Disturbance	BOEM NTL No. 2009-G39; BOEM NTL No. 2009-G40; Chapters 5.10, 6, and 7.9 of the GOM Oil and Gas SID

Regulatory Requirement or Protective Measure	Enforcing Agency	Impact-Producing Factors(s) Reduced/Avoided	Supporting References and Sections
Magnuson-Stevens Fishery Conservation & Management Act of 1976	NMFS; Regional Fisheries Management Councils; BSEE	Bottom Disturbance; Noise; Coastal Land Use/ Modification; Lighting and Visual Impacts; Offshore Habitat Modification/Space Use; Unintended Releases into the Environment	Chapters 1.3 and 4.4.3.2.1 of the GOM Oil and Gas SID
Pollution Prevention	BSEE	Unintended Releases into the Environment	30 CFR § 250.300
Coastal Zone Management Act[1]	NOAA, States	Coastal Land Use/ Modification; Offshore Habitat Modification/ Space Use	16 U.S.C. § 1251 and 15 CFR part 930

[1] A summary of the CZMA enforceable policies for the Gulf Coast States related to OCS plans can be found online at https://www.boem.gov/sites/default/files/environmental-stewardship/Environmental-Assessment/CZMA/CZM-Program-Policies-for-GOM-States.pdf.

4.10.2.1 OCS Oil- and Gas-Related Impact-Producing Factors from Routine Activities

Bottom Disturbance: The activities associated with routine OCS oil and gas operations such as pipelaying, drilling, anchoring, and structure emplacement can have both negative and positive effects on fish and invertebrates. These activities can cause turbidity and sedimentation, which can smother benthic species (e.g., oysters), prey, as well as eggs, larvae, and juvenile fishes, crabs, and shrimp. This can lead to a decrease in the availability of commercially important fish species and ultimately negatively affect commercial fisheries. On the positive side, habitat formation from structure emplacements can benefit fish and invertebrates. To the extent that fish and invertebrates are affected by bottom disturbance, commercial fishing can experience negative effects to potential landings and revenues. More information about of the potential effects of bottom disturbances to localized fish and invertebrate populations are provided in Chapters 4.4 and 4.6 of this Programmatic EIS with more detailed description in Chapters 4.3.2 and 4.3.4 of the GOM Oil and Gas SID and Chapters 4.4 and 4.5 of BOEM’s Biological Environmental Background Report.

Noise: Activities related to OCS oil and gas, including seismic surveys, vessel traffic, propeller cavitation, and rotating machinery, generate sound that can have various effects on fish and invertebrates. These effects range from stimulating behavioral responses to masking biologically important signals. Additionally, exposure to such sound can cause temporary or permanent hearing loss and even result in physiological injury leading to mortality (de Soto 2016; Hastings and Popper 2005; Hawkins and Popper 2014). Although OCS oil- and gas-related activities are not expected to harm fish and invertebrates (**Chapter 4.6**) at a population level, routine activities may indirectly impact commercial fisheries by displacing, harming, or killing localized fish populations. The extent of these effects would depend on the vulnerability of the fish and invertebrate populations. Disruptions to fish populations could reduce landings in proportion to the amount of commercial fisheries activities in the area. Explosive severance, such as platform decommissioning, can lead to fish and invertebrate mortality due to the rapid oscillation in pressure waveform caused by detonation. However, studies on recreationally and commercially important fish species with swim bladders, such as red snapper, greater amberjack, vermillion snapper, grey triggerfish, and cobia, have suggested that the level of explosive severance activity in the GOM does not substantially alter stock levels (Gallaway et al. 2020).

Coastal Land Use/Modification: Changes in coastal land use due to OCS oil and gas operations may lead to changes in species biomass, landings, and other fishing industry variables. Smaller ports may be more vulnerable to market conditions and therefore in need of greater land use controls to prevent the conversion of marine-related uses (Portman et al. 2011). Although coastal land use from OCS oil- and gas-related activities is not expected to have population-level effects to fish and invertebrates (**Chapters 4.6 and 4.3**), localized effects to fish may occur. For example, habitat destruction, erosion and sedimentation, discharge of pollution, alteration of coastal vegetations, and conflict with other land use are some of the potential effects. Fish and invertebrate species important to commercial fisheries can be negatively affected through the modification of coastal vegetation and submerged aquatic vegetation habitats such as salt marsh grasses crucial to various life stages of fish species. Coastal land disturbance can result in a reduction of recreationally important fish, which may negatively affect commercial fisheries through reduced landings and revenues. Coastal land disturbances for OCS oil- and gas-related activities are typically localized in nature, and the amount of coastal construction or dredging associated with new OCS oil- and gas-related activities is relatively low as infrastructure is already largely in place (**Chapter 3**).

Lighting and Visual Impacts: The OCS oil- and gas-related activities can produce artificial lighting from industry-related infrastructure that can interfere with natural predator-prey interactions, causing negative effects to fish and invertebrates. Although lighting from OCS oil- and gas-related activities is not expected to have population-level effects to fish and invertebrates (**Chapters 4.6 and 4.3**), localized effects to fish may occur, such as altered feeding patterns, movement patterns, or avoidance of certain areas due to variations in light intensity, color, and patterns, which could adversely impact commercial fisheries if they rely on any of these areas.

Offshore Habitat Modification/Space Use: Infrastructure emplacements (e.g., platforms) resulting in habitat modification on the OCS can result in an artificial reef effect or act as fish aggregating devices, which can result in increased commercial fishing opportunities and subsequent increases in landings and revenues. Commercial reef fishermen in the GOM are known to fish around oil and gas platforms where they target commercially valuable reef fishes, such as snappers, groupers, and jacks (**Chapter 4.6**). In contrast, the removal of standing platforms on the OCS, particularly in nearshore waters, results in the loss of artificial habitats and easily accessible structures, which can result in decreased fishing opportunities and revenues and increased fuel costs required to target platforms farther offshore. Concerns from the fishing industry over the explosive removals of standing oil and gas platforms, which often result in large quantities of fish mortalities, was the basis for a BOEM-funded study in 2020 (Gallaway et al. 2020) that investigated the impacts of explosive platform removals to stocks of commercially valuable fishes. They found that the current levels of explosive platforms removals and associated mortalities are not expected to result in substantial impacts to stock levels which, in turn, would not be expected to result in stricter fishing regulations that have downstream impacts to revenues.

There is a large amount of vessel traffic in the Gulf of Mexico, particularly within shipping channels leading to and from major ports. Consequently, space-use conflicts between commercial fishing and oil and gas vessels may occur near major ports and in shipping lanes as vessels transit to and from shore. Although, both industries have coexisted in these spaces since the 1940s and potential impacts (e.g., fishing disruptions, gear entanglements, and vessel collisions) arising from space-use conflicts are expected to be rare or minimal.

Socioeconomic Changes and Drivers: Routine OCS oil- and gas-related activities are indirectly associated with socioeconomic changes and drivers that can positively or negatively affect commercial fisheries. To the extent that OCS activity levels increase or decrease, the potential for new structure emplacements increases or decrease. These new structures serve as fish habitats, providing opportunities for commercial fishers to enhance their landing revenues. Furthermore, the utilization of port facilities by the oil and gas industry can infuse funds into ports, leading to enhancement or sustainment of infrastructure that benefit commercial fisheries. Additionally, thriving oil-related employment opportunities attract individuals to coastal areas, fostering a community that appreciates and consumes seafood. In-depth exploration of these socioeconomic variables is provided in Chapter 2.8 of the GOM Oil and Gas SID.

4.10.2.2 OCS Oil- and Gas-Related Impact-Producing Factors from Accidental Events

Unintended Releases into the Environment: Unintended releases into the environment, such as chemical or oil spills, can affect commercial fisheries by affecting the fish and invertebrate populations that support commercial fishing activities, by affecting fishermen's access to those populations, or by affecting the seafood supply chain. For example, an oil spill could have lethal and sublethal effects on fish and shellfish species in the area of the spill. Oil spills in Federal waters would be most likely to affect fisheries for coastal or oceanic species (such as shrimp, menhaden, reef fish, tunas, and groupers), and accidental spills in nearshore waters would be most likely to affect coastal and inshore fisheries (e.g., shrimp, menhaden, oysters, and blue crab). The effects of an oil spill on commercial fisheries would depend on the size and locations of oil spills, species affected, intensity of commercial fishing activity in the affected area, and substitutions available for any lost fishing access. Most oil spills arising from a single oil and gas lease sale would be small, temporary and localized, and weather quickly, leaving commercial fishers numerous alternative fishing sites. For more details, refer to Chapter 4.3.4 of the GOM Oil and Gas SID and **Chapter 3.5.1** of this Programmatic EIS.

Response Activities: Response activities (such as assessing risk, confining a spill, stopping the source, evaluating the incident, implementing cleanup, and decontaminating the site) can cause negative but localized space-use conflicts for commercial fisheries at ports and offshore waters where fishers would need to avoid certain fishing areas while response is ongoing. When it comes to spill-response activities for large spills, commercial fisheries are at risk of being impacted, especially those that rely on non-mobile resources like oysters. In the rare event of a large oil spill near the coast requiring response activities, fisheries like oysters and blue crab are more likely to be impacted than more mobile species and fisheries farther offshore. Dispersant use and improper anchoring can cause mortality among less mobile fish and invertebrate resources, which can in turn negatively affect commercial fisheries. As a result, commercial fisheries can be affected by these negative effects to target species populations, causing reduced landings and revenues, thereby adversely affecting the coastal economies associated with those fisheries. For more details, refer to Chapter 4.3.4 of the GOM Oil and Gas SID.

Strikes and Collisions: Commercial fisheries face a risk of negative impacts from vessel collisions. However, the effects are likely to be localized and not interfere with overall commercial fisheries, except in cases where inland waterways are involved and there is disruption in vessel flow. Such disruptions could potentially impact commercial fishing vessels traveling to and from the port. Any disruptions from strikes and collisions would be expected to be short-term and localized. The likelihood of collisions has decreased with advanced technology of ships, particularly dynamic positioning systems. Furthermore, the USCG's requirements for indicating the location of fixed structures on nautical charts and for lights, sound-producing devices, and radar reflectors to mark fixed structures and moored objects help minimize the risk of collisions. The USCG's Local Notices to Mariners (monthly editions and weekly supplements) also inform users of the Gulf of Mexico OCS (including commercial fishers) about the addition or removal of drilling rigs and platforms, locations of aids to navigation, and defense operations involving temporary moorings. Marked platforms often become aids to navigation for vessels (particularly fishing boats and vessels supporting offshore oil and gas operations) that operate in areas with high densities of fixed structures.

4.10.2.3 Alternatives Analysis

Alternative A – No Action (Cancellation of a Single Proposed OCS Oil and Gas Lease Sale)

Under Alternative A, a proposed OCS oil and gas lease sale would not occur so there would be no new routine activities or accidental events resulting from the proposed action. Therefore, no direct impacts to commercial fisheries would occur as a result of the proposed action (i.e., a proposed oil and gas lease sale), including any potential beneficial effects from structure emplacement. Any indirect effects to commercial fisheries from energy substitution due to cancellation of a single sale would likely be **negligible adverse**. Cancellation of a single proposed oil and gas lease sale would not be expected to cause any noticeable changes in coastal land-use patterns (such as wetlands that are vital to some fisheries) given the expansive existing OCS Oil and Gas Program and the reasonably foreseeable future lease sales anticipated over the next 10 years. However, there are ongoing OCS oil- and gas-related activities and other non-OCS oil- and gas-related activities that contribute to the baseline environment (summarized in **Chapter 4.0.1** of this Programmatic EIS and described in detail in Chapter 3 of the GOM Oil and Gas SID) that also affect commercial fisheries that would still occur. Ongoing activities associated with previous OCS oil and gas lease sales could still have potential direct impacts to commercial fisheries through air emissions and pollution, discharges and wastes, bottom disturbance, coastal land use/modification, noise, lighting/visual impacts, offshore habitat modification/space use, socioeconomic changes and drivers, unintended releases into the environment, response activities, and strikes and collisions. The potential impacts are summarized above in **Chapter 4.10.2.2** of this Programmatic EIS and in greater detail in Chapter 4.4.3 of the GOM Oil and Gas SID.

Comparison of Impacts under Alternatives B, C, and D

A regionwide OCS oil and gas lease sale proposed under Alternatives B through D, and the resulting OCS oil- and gas-related development on any subsequent leases from the lease sale, would result in bottom disturbance, noise, coastal land use/modification, lighting and visual impacts, offshore habitat modification/space use, socioeconomic changes and drivers, unintended releases into the environment, response activities, and strikes and collisions that could potentially impact commercial fisheries.

Alternative B represents the largest geographic area under consideration for a regionwide OCS oil and gas lease sale. Alternatives C and D represent geographical constraints on available acreage for leasing, which could change the spatial distribution of the scenario activities, but not their overall activity levels. Therefore, this alternatives analysis is focused on the potential environmental impacts of a regionwide lease sale (Alternative B), and then considers if these potential impacts could be reduced by the geographic constraint under each alternative considered (Alternatives C and D).

Table 4.10-5 shows the impact determinations for each IPF that affects commercial fisheries for each action alternative analyzed. The impacts of Alternative A are not shown in **Table 4.10-5** because an oil and gas lease sale would not occur and the impacts for all IPFs would be **none**.

Table 4.10-5. Impact Determinations for Routine and Accidental Impacts to Commercial Fisheries for Alternatives B-D.

Impact-Producing Factor	BOEM's Protective Measure(s)[1]	Alternative B	Alternative C	Alternative D
Noise	N/A	**Negligible** to **Minor Adverse**	**Negligible** to **Minor Adverse**	**Negligible Adverse**
Socioeconomic Changes and Drivers	N/A	**Minor Beneficial** to **Minor Adverse**	**Minor Beneficial** to **Minor Adverse**	**Minor Beneficial** to **Minor Adverse**
Bottom Disturbance	N/A	**Negligible**	**Negligible**	**Negligible**
Coastal Land Use/ Modification	N/A	**Negligible** to **Minor Adverse**	**Negligible** to **Minor Adverse**	**Negligible** to **Minor Adverse**
Lighting and Visual Impacts	N/A	**Negligible Beneficial** to **Negligible Adverse**	**Negligible Beneficial** to **Negligible Adverse**	**Negligible Beneficial** to **Negligible Adverse**
Offshore Habitat Modification/Space Use	N/A	**Minor Beneficial** to **Minor Adverse**	**Minor Beneficial** to **Minor Adverse**	**Negligible Beneficial** to **Negligible Adverse**
Unintended Releases into the Environment	N/A	**Negligible** to **Minor Adverse**	**Negligible** to **Minor Adverse**	**Negligible** to **Minor Adverse**
Response Activities	N/A	**Negligible** to **Minor Adverse**	**Negligible** to **Minor Adverse**	**Negligible** to **Minor Adverse**

Impact-Producing Factor	BOEM's Protective Measure(s)[1]	Alternative B	Alternative C	Alternative D
Strikes and Collisions	N/A	**Negligible** to **Minor Adverse**	**Negligible** to **Minor Adverse**	**Negligible** to **Minor Adverse**

Note: Alternative A is not shown in the table because the impacts from all impact-producing factors would be **none** and indirect impacts from the alternative would be **negligible**.

[1] No programmatic protective measures related to commercial fisheries for application at the lease sale stage are being contemplated in this Programmatic EIS. All BOEM protective measures for commercial fisheries would be considered at the site-specific stage.

Alternative B – Regionwide OCS Lease Sale

Within the regionwide lease sale area under Alternative B, various factors such as bottom disturbance, coastal land use/modification, noise, lighting, visual impacts, offshore habitat modification/space use, socioeconomic changes and drivers, unintended releases into the environment, response activities, and strikes and collisions could potentially impact commercial fisheries, as described above in **Chapter 4.10.2.2**.

Bottom Disturbance: Based on the description of potential impacts from bottom disturbance above and the expected amount of activity that would cause bottom disturbance described in **Table 3.3-2**, impacts to commercial fisheries are expected to be **negligible** because the impacts on fish populations and supporting habitats would be minimal (refer to **Chapters 4.3, 4.4, and 4.6**) and mitigated in compliance with the existing regulatory requirements outlined in **Table 4.10-4**. Additionally, most commercial fishing does not target bottom-dwelling species that are more likely to be impacted by localized bottom disturbances.

Coastal Land Use/Modification: Regarding coastal land use/modification, the impacts on commercial fisheries would range from **negligible** to **minor adverse**. Coastal land disturbances for OCS oil- and gas-related activities are typically localized, and few new construction or dredging activities are anticipated in coastal areas resulting from a single OCS oil and gas lease sale (**Table 3.3-2**). Onshore industrial infrastructure is already largely in place.

Noise: Noise impacts on commercial fisheries would also be **negligible** to **minor adverse**. While disruptions to fish populations could reduce landings proportionally to the amount of commercial fisheries activity in an area, stock-level disruptions to recreational species are not expected.

Lighting and Visual Impacts: Impacts from lighting and visual impacts would range from **negligible beneficial** to **negligible adverse**. Fish behavior might be altered at specific locales.

Offshore Habitat Modification/Space Use: Regarding potential OCS space-use conflicts, the impacts of OCS oil- and gas-related vessel traffic on commercial fisheries are expected to be minimal. The exact impacts would depend on activity locations, affected species, the intensity of commercial fisheries in the area, and the substitutability of any lost fishing access. However, due to vessel mobility and the availability of alternative fishing sites, and compliance with the regulatory requirements outlined in **Table 4.10-4**, impacts are anticipated to be **minor beneficial** to **minor adverse**, short-term, and localized.

The impact of offshore habitat modification resulting from structures installed due to a single OCS oil and gas lease sale would likely be **minor** beneficial to **minor adverse** for commercial fisheries. This assessment considers several factors, including the limited activity in Federal waters, the interplay of positive and negative effects from routine OCS oil- and gas-related activities that modify habitat (such as infrastructure emplacement and decommissioning) and their partial offsets to one another, and the influence of regulatory programs like Rigs-to-Reefs (**Table 4.10-4**).

Socioeconomic Changes and Drivers: Regarding OCS oil- and gas-related socioeconomic changes and drivers, the impact would also be **minor beneficial** to **minor adverse**. This conclusion primarily stems from the expected amount of activity described in **Table 3.3-2** and the construction (or lack thereof) of new platforms that facilitate offshore commercial fisheries in comparison to existing infrastructure from past lease sales. Most production structure installations are expected closer to shore, within the water-depth range of 0-200 m (0-656 ft). Notably, structure installation between 0 and 60 m (0 and 197 ft) has nearly the same potential quantity of structures as the 60- to 200-m (0- to 656-ft) range. Consequently, these installations are more accessible to commercial fishers than structures located farther from shore at greater depths (as detailed in **Chapter 3.3.2**). Considering the IPFs analysis, the overall impact conclusion for routine OCS oil- and gas-related activities on commercial fisheries remains **negligible beneficial** to **minor adverse**.

Unintended Releases into the Environment and Response Activities: Accidental events resulting from OCS oil- and gas-related activities from a single OCS oil and gas lease sale could also affect commercial fisheries. Unintended releases into the environment, and associated response activities, would likely be **negligible** to **minor adverse** because most oil spills arising from the proposed action would be small and localized (**Chapter 3.5.1**), leaving commercial fishermen with numerous alternative fishing sites. The exact impacts would depend on the locations of oil spills, affected species, the intensity of commercial fisheries activity in the affected area, and the substitutability of any lost fishing access.

Strikes and Collisions: Strikes and collisions would also likely have **negligible** to **minor adverse** impacts. If a strike or collision were severe enough to interfere with inland waterway traffic or access to a port, a longer duration of interference (such as closure) or lack of access to alternative ports would have a greater impact. According to the National Institute for Occupational Safety and Health (2023), commercial fishing fatalities due to traumatic injuries in the GOM fisheries have decreased over the past decade. Between 2000 and 2009, there were an average of nearly 11.5 commercial fatalities annually, while between 2010 and 2019, there were nearly 8.6 commercial fishing fatalities annually (National Institute for Occupational Safety and Health 2023). However, there is no information available on how many of those fishing fatalities are specifically related to OCS oil- and gas-related activities. Based on the analysis of the IPFs above, the overall impact conclusion for accidental events on commercial fisheries is **negligible** to **minor adverse**.

Therefore, based on the description of the IPFs above and the scenario projections for a single oil and gas lease sale provided in **Chapter 3**, and compliance with the existing regulatory requirements outlined in **Table 4.10-4**, the overall impacts from IPFs associated with Alternatives B on commercial fisheries would range from **minor beneficial** to **minor adverse**.

Alternative C – Inflation Reduction Act Targeted OCS Lease Sale Area

Alternative C involves leasing a subset of the area considered in Alternative B by making blocks that would normally be subject to the Topographic Features, Live Bottom (Pinnacle Trend), and/or Blocks South of Baldwin County, Alabama, Stipulations; Wind Energy Leasing Areas; and Rice's whale critical habitat unavailable for lease. Alternative C represents a geographical constraint on available acreage for leasing, which could cause a change in the spatial distribution of activities compared to Alternative B, but not the types of activities or their overall levels. This potential spatial redistribution of activity does not affect commercial fishing from a regional perspective because overall exploration and development activity levels would be the same. Therefore, the analysis for Alternative B (described above) also covers the range of potential impacts from Alternative C. However, Alternative C could reduce localized space-use conflicts and potential impacts to commercial fisheries from noise, bottom disturbance, habitat loss, and oil spills in the areas excluded from leasing. For example, fishermen would likely not use certain gear types, such as bottom trawls, near topographic features and other hard bottom features in the excluded areas, thereby avoiding snags and damage to fishing gear and/or lost catch. Conversely, Alternative C introduces additional restrictions on offshore oil- and gas-related activities, which would also preclude the possibility of beneficial effects stemming from new platforms or other fish attractions in the excluded areas. Therefore, the impact conclusions for Alternative C range from **negligible** to **minor beneficial** and **negligible** to **minor adverse**.

Alternative D – Targeted OCS Lease Sale Area with Additional Exclusions

Alternative D represents a further geographical constraint on available acreage for leasing, which could cause a change in the spatial distribution of activities compared to Alternative B, but not the types of activities or their overall levels. This potential distribution of activities could be especially noticeable in Texas and western Louisiana with the removal of the entire GOM Wind Leasing Call Area and waters shoreward of the 20-m (66-ft) isobath, which could alter the spatial distribution of the positive and negative impacts identified under Alternative B. For example, the geographic extent of potential production structures from a proposed oil and gas lease sale in shallower OCS waters, which commercial fishermen may prefer to target as a potential fishing ground, is much more restrictive than in the other alternatives. However, it would not affect other areas of the GOM to the same extent nor would it necessarily reduce the amount of activity resulting from an oil and gas lease sale from a regional perspective. Therefore, the analyses for Alternative B (described above) also covers the range of potential impacts from Alternative D from a regional perspective. By excluding oil and gas activity from additional areas, however, Alternative D could reduce potential space-use conflicts and impacts to commercial fishing operations. Fishermen tend to avoid using certain equipment, like bottom trawls, in topographic locations due to the risk of entanglement and damage to gear. Conversely, Alternative D introduces additional restrictions on offshore oil- and gas-related activities, which would also preclude the possibility of beneficial effects stemming from new platforms or other fish attractions in the excluded areas. Impacts from routine activities would more than likely be **negligible beneficial** to **negligible adverse** considering the vast overlap of most commercial fishing grounds with the exclusion areas, as well as the mitigating effects of existing regulatory requirements and protective measures as outlined in **Table 4.10-4**. In some instances, there may still be the potential for **minor adverse** impacts from large oil spills and response activities if they travel into fishing grounds within the excluded areas. Therefore, BOEM concludes the impacts of this further reduced area would vary from **negligible beneficial** to **minor adverse** from a regional perspective.

4.10.3 Incomplete or Unavailable Information

BOEM has identified incomplete or unavailable information that may be relevant to reasonably foreseeable impacts on commercial fisheries. Some of this incomplete or unavailable information relates to fish populations that support commercial fishing, which is discussed in **Chapter 4.6**. For instance, the long-term effects of acute and chronic oil exposure on fish and invertebrates that are crucial for commercial fishing are still uncertain, as they may take time to manifest. Similarly, little is known about the uptake of polycyclic aromatic hydrocarbons (PAHs) from oil exposure on fish species. The response of GOM-specific fish species to anthropogenic sound also remains highly variable and poorly understood. To address these gaps, BOEM relied on a range of data sources and studies to estimate the environmental impact of both OCS oil- and gas-related activities and non-OCS oil and gas activities on commercial fishing (Chapters 4.4.2.2.1 and 4.4.2.2.2 of the GOM Oil and Gas SID). BOEM continuously pursues collaborative research, and ongoing efforts are necessary to bridge the gaps and enhance our knowledge. Fisheries production in the GOM region as a whole remained relatively stable before and after the *Deepwater Horizon* oil spill (Swinea and Fodrie 2021). For instance, between 2005 and 2009, the average landing over a 5-year period was 627.2 thousand metric tons, whereas between 2011 and 2015, the average landing over a 5-year period was 688.2 thousand metric tons. BOEM has determined that such information is not essential to a reasoned choice among alternatives because existing data sources provide sufficient information. BOEM has used the best available scientific information to date and reasonably accepted scientific methodologies to extrapolate from existing information. Therefore, the incomplete or unavailable information, while relevant, would not likely change the impact conclusions reached in this analysis and is not essential to a reasoned choice among alternatives.

4.11 Recreational Fishing

Marine recreational fishing in the Gulf of Mexico is very popular with both residents and tourists, and it is economically important to the coastal states of Florida, Alabama, Mississippi, Louisiana, and Texas. The recreational fishing resource category includes land-based, coastal, and offshore fishing. Recreational fishing is primarily confined to smaller, closer inshore areas of the Gulf of Mexico than commercial fishing. This resource includes private land- and vessel-based fishing, rental boat fishing, and charter boat fishing. Recreational fishing activities on the OCS take several forms (e.g., bottom fishing, trolling, and spearfishing).

4.11.1 Affected Environment

Recreational fishing is a popular pastime in many parts of the Gulf of Mexico. The GOM's extensive estuarine habitats, live bottom habitats, and artificial substrates (including artificial reefs, shipwrecks, and oil and gas platforms) support several valuable recreational fisheries. Fisheries are managed by NMFS, as advised by the regional fisheries management councils. Details regarding the most recent regulatory mechanisms relevant to recreational fishing are described by the Gulf of Mexico Fishery Management Council (2023). Recreational landings and effort data for Mississippi, Alabama, and Florida are provided by NMFS; recreational fishing data for Louisiana is provided by the Louisiana Department of Wildlife and Fisheries; and recreational fishing data for Texas is provided by the Texas Parks and Wildlife Department. Chapter 4.4.3 of the GOM Oil and Gas SID presents these data as part of its recreational fishing analysis, and the biological aspects of the affected environment are discussed in **Chapter 4.3.4** of this Programmatic EIS. The data demonstrates that, through time, the least amount of recreational fishing for the Gulf Coast States occurs in Federal waters, where most OCS oil- and gas-related activities occur. Most recreational fishing takes place from shore and/or in State waters (Fisher 2023b; LDWF 2023a; NMFS 2023f). Within the OCS, some of the most popular species (by quantity) caught recreationally include Epinephelus grouper (*Epinephelus* spp.), gray snapper (*Lutjanus griseus*), herrings (Clupeidae), red snapper (*Lutjanus campechanus*), triggerfish/filefish (Balistidae/Monacanthidae), vermilion snapper (*Rhomboplites aurorubens*), white grunt (*Haemulon plumierii*), and yellowtail snapper (*Ocyurus chrysurus*) (Fisher 2023a; LDWF 2023b; NMFS 2023e). Additionally, Camp et al. (2018) present baseline data on the distances traveled by anglers to fish for various species near Florida. Farmer et al. (2020) present a case study of the forecasting methods used to estimate GOM red snapper Federal recreation seasons.

The COVID-19 pandemic had varying impacts on recreational fishing in the GOM. Some recreational fishing experienced negative economic impacts in the first half of 2020 due to pandemic-related shutdowns, supply-chain disruptions, decreases in demand, losses of revenues, and increased costs related to necessary safety precautions to prevent the spread of the virus (e.g., purchasing personal protective equipment, testing workers, quarantining) (NMFS 2021b; Upton 2020). This was especially pronounced among charter fishing trips. For example, from January through June 2020, 94 percent of charter boat operators from North Carolina to Mississippi experienced revenue losses averaging 58 percent when compared to the same time period in 2019, with roughly 47 percent of operators shutdown completely for 1-3 months (NMFS 2021d). This differed from non-charter recreational fishing, however, as the GOM region experienced a 50 percent increase of aggregate fishing trips in 2020 compared to previous years due to decreased access to fishing (Apriesnig and Thompson 2021). In Louisiana, some regions experienced a roughly 150 percent higher increase in recreational fishing for some months in 2020 (Midway and Miller 2023). The increase in the fishing effort was due in part to lost jobs or lost work hours of anglers (Midway et al. 2021). Many anglers reported that fishing helped with mental stress and family bonding during the pandemic. In Louisiana, recreational fishing trips began to fall back to pre-pandemic levels towards the end of the year and going into 2021 (Midway and Miller 2023).

Offshore recreational trips in the GOM have demonstrated uneven trends in the recent years during and after the pandemic. A look at NMFS data for the GOM (which excludes Texas and Louisiana) shows that from 2019 through 2023, specific to OCS recreational fishing, for-hire angler trips continued to decrease from an estimated 659,174 in 2019 to 534,166 in 2023 while private recreational fishing trips declined to a low of 2,587,871 in 2021 from a high of 3,346,396 in 2019, with 2023 rebounding to an estimated 3,030,007 trips (NMFS 2024). In Louisiana during the same period, charter trips offshore peaked in 2023 at an estimated 27,564 from a low of 12,199 in 2022 and private trips offshore peaked in 2021 at estimated 104,034 before declining to 55,624 in 2023 (LDWF 2024).

Warming waters resulting from climate change have caused northward expansions of tropical and subtropical fish species. Land loss and sea-level rise resulting from climate change and major storm effects can also alter estuarine habitats, which support a wide variety of fishes and invertebrates at various life stages (**Chapter 4.3**). As most recreational fishing occurs inland and in State waters, changes to coastal habitats could impact the availability of recreational target species, making the habitat less or more attractive depending on the species (although habitat change would imply that historical species in a given habitat would be impacted negatively).

4.11.2 Environmental Consequences

Recreational fishing in the GOM is affected by existing environmental conditions, natural processes and phenomena, and human-induced factors. There are several OCS oil- and gas-related activities and non-OCS oil- and gas-related activities that have the potential to impact recreational fishing (**Table 4.11-1**). BOEM conducted an initial screening of potential IPFs in the GOM Oil and Gas SID and determined that bottom disturbance, coastal land use/modification, noise, lighting and visual impacts, offshore habitat modification/space use, socioeconomic changes and drivers, unintended releases into the environment, response activities, strikes and collisions, climate change, and natural processes could potentially impact recreational fishing. These IPFs and their potential to affect recreational fishing are discussed below and in greater detail in Chapter 4.4.3 of the GOM Oil and Gas SID. Supporting rationale for IPFs that were not analyzed in detail in this Programmatic EIS can also be found in Chapter 4.4.3 of the GOM Oil and Gas SID. New information released since the development of the GOM Oil and Gas SID and relevant to the analysis is included in the applicable chapters below.

Table 4.11-1. Impact-Producing Factors with the Potential to Impact Recreational Fishing.

OCS Oil- and Gas-Related Routine Activities	OCS Oil- and Gas-Related Accidental Events	Non-OCS Oil- and Gas-Related Activities
Bottom Disturbance	Unintended Releases into the Environment	Air Emissions and Pollution
Coastal Land Use/ Modification	Response Activities	Discharges and Wastes
Noise	Strikes and Collisions	Bottom Disturbance
Lighting and Visual Impacts	-	Coastal Land Use/Modification
Offshore Habitat Modification/ Space Use	-	Noise

OCS Oil- and Gas-Related Routine Activities	OCS Oil- and Gas-Related Accidental Events	Non-OCS Oil- and Gas-Related Activities
Socioeconomic Changes and Drivers	-	Lighting and Visual Impacts
-	-	Offshore Habitat Modification/Space Use
-	-	Socioeconomic Changes and Drivers
-	-	Climate Change
-	-	Natural Processes
-	-	Other Cumulative Factors

There are several existing regulatory programs and requirements that reduce or minimize the environmental effects of these IPFs to recreational fishing in the GOM (**Table 4.11-2**) and are enforced by BOEM, BSEE, and other agencies. The *Gulf of Mexico OCS Regulatory Framework* technical report (BOEM 2020a) overviews the complex interconnected regulatory regime that exists around GOM activities. Lessees are required to perform OCS oil- and gas-related activities in accordance with regulatory requirements, therefore, the analysis factors in the mitigating effects of all applicable regulatory requirements as part of the proposed action when making impact determinations.

Table 4.11-2. Existing Regulatory Requirements and Protective Measures That Reduce Potential Impacts of Impact-Producing Factors.

Regulatory Requirement or Protective Measure	Enforcing Agency	Impact-Producing Factor(s) Reduced/Avoided	Supporting References and Sections
Clean Water Act (NPDES Permits)	USEPA	Discharges and Wastes	Chapter 5.11 of the GOM Oil and Gas SID
Magnuson-Stevens Fishery Conservation and Management Act	Regional Fishery Management Councils	Bottom Disturbance; Noise; Coastal Land Use/ Modification; Lighting and Visual Impacts; Offshore Habitat Modification/Space Use; Discharges and Wastes; Unintended Releases into the Environment	50 CFR part 600
National Fishing Enhancement Act	Secretary of Commerce, BSEE, State agencies	Offshore Habitat Modification/ Space Use	Chapters 2.3.2.4 and 5.3 of the GOM Oil and Gas SID

4.11.2.1 OCS Oil- and Gas-Related Impact-Producing Factors from Routine Activities

Bottom Disturbance: Bottom-disturbing activities associated with routine OCS oil- and gas-related activities (e.g., pipelaying, drilling, anchoring, and structure emplacement activities) can cause negative effects (e.g., turbidity and sedimentation). Turbidity can cause smothering of benthic prey as well as eggs, larvae, and juvenile fishes that may be fished recreationally. Harm or death to fish and invertebrates as a result of smothering can negatively affect recreational fishing by decreasing the availability of fish. To the extent that fish and invertebrates are affected by bottom disturbance, recreational fishing can experience negative effects to potential landings, revenues, and associated fisheries reliant economies. More information about of the potential effects of bottom disturbances to localized fish and invertebrate populations are provided in **Chapters 4.4 and 4.6** of this Programmatic EIS with more detailed description in Chapters 4.3.2 and 4.3.4 of the GOM Oil and Gas SID and Chapters 4.4 and 4.5 in the Biological Environmental Background Report.

Coastal Land Use/Modification: Coastal land use from OCS oil- and gas-related activities is not expected to have population-level effects to fish and invertebrates (refer to **Chapters 4.3 and 4.6** of this Programmatic EIS and Chapters 4.3.4 and 4.3.1 of the GOM Oil and Gas SID), although localized effects to fish may occur. Recreational fishing can be indirectly and negatively affected by routine OCS oil- and gas-related coastal land disturbance activities such as construction of new onshore facilities, pipeline landfalls, and navigation canal dredging that can negatively affect fish and invertebrate resources or reduce access to preferred fishing areas and infrastructure (e.g., boat launches). Fish and invertebrate species important to recreational fisheries can be negatively affected through the modification of coastal vegetation and submerged aquatic vegetation habitats such as salt marsh grasses crucial to various life stages of fish species. Coastal land disturbance can result in a reduction of recreationally important fish, which may negatively affect recreational fishing through reduced landings, which could lead to reduced charter trips. Land-disturbing activities may negatively affect recreational fishing to the extent that reduced catch interferes with recreational fishers' aesthetic enjoyment and potentially decrease desirability of the area where activities are occurring. Coastal land disturbances for OCS oil- and gas-related activities are typically localized in nature, and the amount of coastal construction or dredging associated with new OCS oil- and gas-related activities is relatively low as infrastructure is already largely in place (refer to **Chapter 3**).

Noise: Anthropogenic sound caused by routine OCS oil- and gas-related activities (e.g., seismic surveys, vessel traffic, propeller cavitation, and rotating machinery) may negatively affect recreational fishing indirectly through displacement, physical harm, or fatalities within localized fish populations. However, sound from OCS oil- and gas-related activities is not expected to have population-level effects to fish and invertebrates (refer to **Chapter 4.6** of this Programmatic EIS and Chapter 4.3.4 of the GOM Oil and Gas SID). Disruptions to fish populations could reduce landings in proportion to the amount of recreational fishing activities in an area.

Lighting and Visual Impacts: Although lighting from OCS oil- and gas-related activities is not expected to have population-level effects to fish and invertebrates (refer to **Chapter 4.6** of this Programmatic EIS and Chapter 4.3.4 of the GOM Oil and Gas SID), localized effects to fish may occur. Artificial lighting associated with routine OCS oil- and gas-related activities (e.g., offshore standing platforms, tension-leg platforms, drillships, onshore facilities, and docked vessels) can affect localized fish and invertebrate resources by altering predator-prey interactions and larval settlement site selection. Artificial lighting can cause beneficial effects because many recreational fishers enjoy night fishing near offshore platforms where the lights attract fish to be caught. The impacts of lighting and visual impacts on recreation fishing would be based on its facilitation of nighttime fishing and in possibly altering fish behavior in particular areas. Specifically localized, adverse impacts to the richness or abundance of species common to the area of effect would be expected.

Offshore Habitat Modification/Space Use: Although offshore habitat modification from OCS oil- and gas-related activities is not expected to have population-level effects to fish and invertebrates (refer to **Chapter 4.6** of this Programmatic EIS and Chapter 4.3.4 of the GOM Oil and Gas SID), localized effects to fish may occur. Offshore habitat modification from OCS oil- and gas-related activities can cause potential effects to fish and invertebrate resources, which range from positive (e.g., structure emplacement adding new habitat) to negative (e.g., structure removal reducing habitat). For example, OCS oil- and gas-related structures could enhance reef fish habitat and thus improve some fishing opportunities by congregating fish populations near the structures (Scott-Denton et al. 2011). Hiett and Milon (2002) estimate that 20.2 percent of private boat fishing, 32.2 percent of charter boat fishing, and 50.9 percent of party boat fishing in Texas, Louisiana, Mississippi, and Alabama combined occur within 300 ft (91 m) of an oil or gas structure in State or Federal waters. The extent to which a platform would serve as an attractor to fish would depend on the fish populations in nearby areas and the extent to which structure emplacement would support recreational fishing activity would depend on location. The removal of a platform would preclude its use for recreational fishing unless it is redeployed as artificial reef substrate as part of an artificial reef program. More information about of the potential effects of offshore habitat modification/space use to localized fish and invertebrate populations is provided in **Chapters 4.4 and 4.6** of this Programmatic EIS with a more detailed description in Chapters 4.3.2 and 4.3.4 of the GOM Oil and Gas SID and Chapters 4.4 and 4.5 of BOEM's Biological Environmental Background Report.

Space-use conflicts also can cause negative effects to recreational fishing that arise from routine OCS oil and gas operations such as seismic surveys, pipeline emplacement, drilling, and production structure emplacement and removals in that recreational fishing cannot occur in the same areas where some of these OCS oil- and gas-related activities are taking place. The nature of space-use conflicts from these activities depend on the durations of the activities, as well as the locations and species affected. For example, structure emplacement prevents trolling in the associated area because gear can become entangled with the structure as the fishing vessel passes.

The OCS oil- and gas-related vessel traffic contributes to space-use conflicts with recreational fishers. The OCS vessel traffic would occur between ports that service the offshore industry and drilling and production facilities in Federal waters. However, there is limited spatial overlap between recreational fishing and oil and gas ports. In addition, most recreational fishing activities in the Gulf of Mexico occur inland or in State waters. Recreational vessels can often easily avoid temporary OCS vessel traffic. The extent of potential effects would depend on the locations of activities, the species affected, the intensity of recreational fishing activity in the affected area, and the substitutability of any lost fishing access.

Socioeconomic Changes and Drivers: Routine OCS oil- and gas-related activities are indirectly associated with socioeconomic changes and drivers that can positively or negatively affect recreational fisheries. For example, to the extent that OCS activity levels increase, the potential for new structure emplacements increase, which creates new fish habitats and opportunities for recreational fishers to visit. Similarly, to the extent that OCS activity levels decrease, the potential for new structure emplacements decrease, reducing opportunities for recreational fishers to visit, as well as reducing the number of charter boats that visit these structures.

4.11.2.2 OCS Oil- and Gas-Related Impact-Producing Factors from Accidental Events

Unintended Releases into the Environment: The exact effects of an unintended release, especially an oil spill, on recreational fisheries would depend on the locations of oil spills, the species affected, the intensity of recreational fishing activity in the affected area, and the substitutions available for any lost fishing access. Oil spills and other accidental events could indirectly affect recreational fishing activity through their effects on fish and their habitats in the affected areas. A spill could either contaminate fish in the immediate area or cause fish to move during the duration of the spill. A spill would likely cause more direct harm to larvae and eggs than adults, which could possibly affect recreational species in the longer term. Should fish populations that support recreational fishing decline, recreational fishing activity could decline as well, negatively affecting the economic supply chain related to recreational fishing. More information about the potential effects of oil spills on fish populations that support recreational fishing are described in **Chapters 4.3 and 4.6** of this Programmatic EIS and described in detail in Chapters 4.3.1 and 4.3.4 of the GOM Oil and Gas SID and Chapters 4.4 and 4.5 of the Biological Environmental Background Report (BOEM 2021b). Oil spills can also lead to localized fishing closures that could directly affect fishermen's access to fish resources. The size of the closure would be dependent on the size of the oil spill. Small-scale spills should not affect recreational fishing to a large degree due to the likely availability of substitute fishing sites in neighboring regions. A large spill can have substantial effects on recreational fishing due to the larger potential closure regions, and due to the wider economic implications that such closures can have. However, the longer-term implications of a large oil spill would primarily depend on the extent to which fish ecosystems recover after the spill has been cleaned. Refer to Chapter 4.4.3.2.3 of the GOM Oil and Gas SID for further discussion.

Response Activities: Spill-response activities (e.g., the use of chemical dispersants) can cause negative but localized space-use conflicts for recreational fishing at ports and offshore where fishers would need to avoid certain fishing areas while spill response is ongoing. Spill-response activities may affect fish and invertebrate resources, particularly oysters, because such resources are not mobile, cannot engage in avoidance behaviors, and can suffer mortality caused by dispersant use or improper anchoring. As a result, recreational fishing can be affected by these negative effects to target species' populations, causing reduced landings and adversely affecting charter boat revenues and by extension, the coastal economies associated with those fisheries.

Strikes and Collisions: Recreational fishing may be negatively affected by vessel collisions; however, these would be localized in effect and not likely to interfere with recreational fishing activities unless they occur on inland waterways and disrupt the flow of vessels, possibly interfering with fishing vessels coming from and going to port. Even then, the disruption would be expected to be short term with minimal localized effects. Accidental strikes typically would not affect most fish and invertebrates because their mobility allows them to avoid vessels.

4.11.2.3 Alternatives Analysis

Alternative A – No Action (Cancellation of a Single Proposed OCS Oil and Gas Lease Sale)

Under Alternative A, a proposed OCS oil and gas lease sale would not occur, so there would be no new routine activities or accidental events resulting from the proposed action. No direct impacts to recreational fishing would occur as a result of the proposed action (i.e., a single proposed oil and gas lease sale). Indirect impacts to recreational fishing from the cancellation of a single OCS oil and gas lease sale would be **negligible** (mostly stemming from possible economic impacts, refer to **Chapter 4.15**). Additionally, there are ongoing OCS oil- and gas-related activities and other non-OCS oil- and gas-related activities that contribute to the baseline environment (summarized in **Chapter 4.0.1** of this Programmatic EIS and described in detail in Chapter 3 of the GOM Oil and Gas SID) that also affect recreational fishing that would still occur. Ongoing activities associated with previous OCS oil and gas lease sales could still have potential direct impacts to recreational fishing through bottom disturbance, coastal land use/modification, noise, lighting/visual impacts, offshore habitat modification/space use, socioeconomic changes and drivers, unintended releases into the environment, response activities, and strikes and collisions. The potential impacts are summarized above in **Chapter 4.11.2.2** of this Programmatic EIS and in greater detail in Chapter 4.4.3 of the GOM Oil and Gas SID.

Comparison of Impacts under Alternatives B, C, and D

A regionwide OCS oil and gas lease sale under Alternatives B through D, and the resulting OCS oil- and gas-related activities from any subsequent leases, would result in bottom disturbance, coastal land use/modification, noise, lighting and visual impacts, offshore habitat modification/space use, socioeconomic changes and drivers, unintended releases into the environment, response activities, and strikes and collisions that could potentially impact recreational fishing. Alternative B represents the largest geographic area under consideration for a regionwide OCS oil and gas lease sale. Alternatives C and D represent geographical constraints on available acreage for leasing that could change the spatial distribution of the scenario activities but not their overall activity levels. Therefore, this alternatives analysis is focused on the potential environmental impacts of a regionwide lease sale (Alternative B) and then considers if these potential impacts could be reduced by the geographic constraints under Alternatives C and D.

Table 4.11-3 shows the impact determinations for each IPF that affects recreational fishing for each action alternative analyzed. The impacts of Alternative A are not shown in **Table 4.11-3** because an oil and gas lease sale would not occur and the impacts for all IPFs from the proposed action would be avoided.

Table 4.11-3. Impact Determinations for Routine and Accidental Impacts to Recreational Fishing for Alternatives B-D.

Impact-Producing Factor	BOEM's Protective Measure[1]	Alternative B	Alternative C	Alternative D
Bottom Disturbance	N/A	**Negligible**	**Negligible**	**Negligible**
Coastal Land Use/ Modification	N/A	**Negligible** to **Minor**	**Negligible** to **Minor**	**Negligible** to **Minor**
Noise	N/A	**Negligible** to **Minor**	**Negligible** to **Minor**	**Negligible** to **Minor**
Lighting and Visual Impacts	N/A	**Beneficial** to **Negligible**	**Beneficial** to **Negligible**	**Beneficial** to **Negligible**
Offshore Habitat Modification/Space Use	N/A	**Beneficial** to **Minor**	**Beneficial** to **Minor**	**Beneficial** to **Minor**
Socioeconomic Changes and Drivers	N/A	**Beneficial** to **Minor**	**Beneficial** to **Minor**	**Beneficial** to **Minor**
Unintended Releases into the Environment	N/A	**Negligible** to **Minor**	**Negligible** to **Minor**	**Negligible** to **Minor**
Response Activities	N/A	**Negligible** to **Minor**	**Negligible** to **Minor**	**Negligible** to **Minor**
Strikes and Collisions	N/A	**Negligible** to **Minor**	**Negligible** to **Minor**	**Negligible** to **Minor**

Note: Alternative A is not shown in the table because the impacts from all impact-producing factors is **negligible**.
[1] No recreational fishing specific programmatic protective measures for application at the lease sale stage are being contemplated in this Programmatic EIS.

Alternative B – Regionwide OCS Lease Sale

Within the regionwide OCS oil and gas lease sale area under Alternative B, bottom disturbance, coastal land use/modification, noise, lighting and visual impacts, offshore habitat modification/space use, socioeconomic changes and drivers, unintended releases into the environment, response activities, and strikes and collisions could potentially impact recreational fishing as described above in **Chapters 4.11.2.1 and 4.11.2.2**.

Impacts from routine OCS oil- and gas-related activities from a single OCS oil and gas lease sale could be felt by recreational fisheries. Impacts of short-term **bottom disturbances** on recreational fishing are expected to be **negligible** because the impacts to fish populations would similarly be **negligible** and because most recreational fishing does not target bottom-dwelling species that are more likely to be impacted by these localized disturbances. The impacts of **coastal land use/modification** on recreational fishing would be **negligible** to **minor** because coastal land disturbances for OCS oil- and gas-related activities are typically localized in nature and few new construction or dredging activities are anticipated in coastal areas as a result of a single oil and gas lease sale. The impacts of **noise** on recreational fishing would be **negligible** to **minor** because disruptions to fish populations could reduce landings in proportion to the amount of recreational fishing activities in an area, although stock-level disruptions to recreational species are not expected. The impacts of **lighting and visual impacts** on recreation fishing would be **minor beneficial** to **negligible** based on its facilitation of nighttime fishing and in possibly altering fish behavior at specific locales. In terms of potential ***offshore space-use*** conflicts, the impacts of OCS oil- and gas-related vessel traffic on recreational fishing are expected to be **negligible** to **minor**. The actual impacts would depend on the locations of activities, the species affected, the intensity of recreational fishing activity in the affected area, and the availability of substitute fishing access. Given vessel mobility and availability of many alternative fishing sites, impacts are expected to be **negligible** to **minor,** short-term, and localized. The ***offshore habitat modification*** impact from structures installed due to a proposed oil and gas lease sale would likely be **minor beneficial** to **minor** on recreational fishing because of the limited amount of activity that occurs in Federal waters and because the positive and negative effects of routine OCS oil- and gas-related activities that modify habitat (i.e., infrastructure emplacement and decommissioning) would partially offset each other. The impacts of OCS oil- and gas-related ***socioeconomic changes and drivers*** would be **minor beneficial** to **minor adverse** based primarily on the construction, or not, of new platforms that facilitate offshore recreational fishing. Under a proposed oil and gas lease sale, most production structure installation is expected closer to shore, between 0- and 200-m (0- and 656-ft) water depth, with structure installation between 0 and 60 m (0 and 656 ft) having nearly the same potential quantity of structures as 60-200 m (197-656 ft), making them more accessible to recreational fishers than structures farther from shore at greater depths (refer to **Chapter 3.3.2**). Based on the analysis of the IPFs above, the overall impact conclusion for routine OCS oil- and gas-related activities on recreational fishing is **minor beneficial** to **minor adverse**.

Impacts from accidental events from a single OCS oil and gas lease could also be felt by recreational fisheries. Impacts from unintended releases into the environment would likely be **negligible** to **minor** because most oil spills arising from a single OCS oil and gas lease sale would be small and localized (refer to **Chapter 3.5.1**), leaving recreational fishermen numerous alternative fishing sites. The exact impacts would depend on the locations of oil spills, the species affected, the intensity of recreational fishing activity in the affected area, and the substitutability of any lost fishing access. Impacts from response activities would likely by **negligible** to **minor** because the oil spill itself would likely be small and localized. Impacts from strikes and collisions would likely be **negligible** to **minor** were a strike or collision be severe enough to interfere with inland waterway traffic or access to a port, with a longer duration of interference (such as closure) or lack of access to alternative ports having a greater impact. Based on the analysis of the IPFs above, the overall adverse impacts from accidental events on recreational fishing would range from **negligible** to **minor**.

Therefore, based on the description of the IPFs above and the scenario projections for a single proposed OCS oil and gas lease sale provided in **Chapter 3**, the overall impacts from IPFs associated with Alternatives B on recreational fishing would be **minor beneficial** to **minor adverse**.

Alternative C – Inflation Reduction Act Targeted OCS Lease Sale Area

Alternative C represents a geographical constraint on available acreage for leasing, which could cause a change in the spatial distribution of activities compared to Alternative B, but not the types of activities or their overall levels. This potential spatial redistribution of activity does not affect recreational fishing because overall activity levels would be the same. The IPFs from routine activities and accidental events are also unchanged from Alternative B, **minor beneficial** to **minor adverse**, though the removal of the wind energy areas, SSRAs, and other blocks (**Figure 2.2-2**) could reduce the probability of some accidental events being experienced in adjacent coastal areas, especially in Texas and western Louisiana where recreational fishing is common.

Alternative D – Targeted OCS Lease Sale Area with Additional Exclusions

Alternative D represents a geographical constraint on available acreage for leasing, which could cause a change in the spatial distribution of activities compared to Alternative B, but not the types of activities or their overall levels. This potential distribution of activities could be especially noticeable in Texas and western Louisiana with the removal of the entire Gulf of Mexico Wind Leasing Call Area and waters shoreward of the 20-m (66-ft) isobath, which could alter the spatial distribution of the positive and negative impacts identified under Alternative B. For example, the geographic extent of potential production structures from a proposed oil and gas lease sale in shallower OCS waters, which recreational fishermen may prefer to target as a potential fishing ground, is much more restrictive than in the other alternatives. However, it would not affect other areas of the GOM to the same extent nor would it necessarily reduce the amount of activity resulting from an oil and gas lease sale. The IPFs from routine activities and accidental events are unchanged from Alternative B. Therefore, the routine activity and accidental event impacts to recreational fishing under Alternative D would be **minor beneficial** to **minor**.

4.11.3 Incomplete or Unavailable Information

BOEM has identified incomplete or unavailable information that may be relevant to reasonably foreseeable impacts on recreational fishing regarding the extent to which recreational fishing is dependent upon OCS platforms, as well as on the site-specific determinants of this dependency. In lieu of this incomplete or unavailable information, BOEM used existing information and reasonably accepted scientific methodologies. For example, BOEM used data on recreational fishing activity provided by the Louisiana Department of Wildlife and Fisheries, the Texas Parks and Wildlife Department, and NMFS to examine trends in recreational fishing in various areas. BOEM has also used information from Hiett and Milon (2002) and Ajemian et al. (2015), which provide some information on the scale and location of platform-dependent recreational fishing. BOEM has determined that such information is not essential to a reasoned choice among alternatives because BOEM still has enough baseline data to reasonably estimate impacts. BOEM has used the best available scientific information to date and reasonably accepted scientific methodologies to extrapolate from existing information. Therefore, the incomplete or unavailable information, while relevant, would not likely change the impact conclusions reached in this analysis and is not essential to a reasoned choice among alternatives.

4.12 RECREATIONAL RESOURCES

Recreational resources are natural or manmade things that are used as part of activities that are primarily for human enjoyment, including tourism. The Gulf Coast is home to various ocean and land-based resources that support recreational activities including coastal beaches, barrier islands, estuarine bays and sounds, river deltas, and tidal marshes enjoyed by residents of the Gulf Coast and tourists from throughout the Nation and globally. Publicly owned and administered areas (such as national seashores, parks, beaches, marine protected areas, artificial reefs, and wildlife lands), as well as specially designated preservation areas (such as historic and natural sites and landmarks, wilderness areas, wildlife sanctuaries, and scenic rivers) attract residents and visitors throughout the year. Commercial and private recreational facilities and establishments (such as resorts, casinos, marinas, amusement parks, and ornamental gardens) also serve as primary interest areas and support services for people who seek enjoyment from the recreational resources near the Gulf of Mexico.

4.12.1 Affected Environment

The recreation and tourism industries are sizable in many areas along the Gulf Coast and are susceptible to effects from past, present, and future OCS oil- and gas-related activities and non-OCS oil- and gas-related activities. In 2020, the tourism and recreation sector was the largest employment sector in the Gulf of Mexico's marine economy, making up 56 percent of marine employment (NOAA Office for Coastal Management 2022). By state, the tourism and recreation sector led in marine economy employment for Louisiana (45%), Mississippi (46%), Alabama (61%), and Florida (75%) (NOAA Office for Coastal Management 2022). Texas was the only Gulf Coast State where the marine tourism and recreation sector was not the largest employer in the marine economy but instead was led by offshore mineral resources employment (41%) (NOAA Office for Coastal Management 2022).

Beach visitation is one of the most popular recreational activities among coastal states. Beaches along the Gulf Coast could have their availability for recreational use affected, as well as have alterations made to the unique characteristics enjoyed by recreators, such as specific natural features or types of wildlife that frequent a location. Wildlife tourism is another prominent feature of the Gulf Coast's recreational landscape available to residents and visitors alike, and it is also vulnerable to effects from OCS oil- and gas-related activities and non-OCS oil- and gas-related activities. Artificial reefs are also prolific in the GOM and support many recreational opportunities. The GOM is home to many marine protected areas that support recreational activities such as wildlife viewing, nature experiences, and beach visitation. The marine protected areas in the area of interest include various Federal and State entities such as parks, wildlife refuges, national marine sanctuaries, and national seashores. For example, there are six units of the National Park System located on or near the shorelines and in State waters adjacent to the OCS lease areas being considered in this Programmatic EIS, including Palo Alto Battlefield National Historical Park, Padre Island National Seashore, Big Thicket National Preserve, Jean Lafitte National Historical Park and Preserve, New Orleans Jazz National Historical Park, and the Gulf Islands National Seashore (**Figure 4.12-1**). Additionally, there are numerous historic sites, natural landmarks, wilderness areas, and other features managed by the NPS and other Federal agencies (**Figure 4.12-1**).

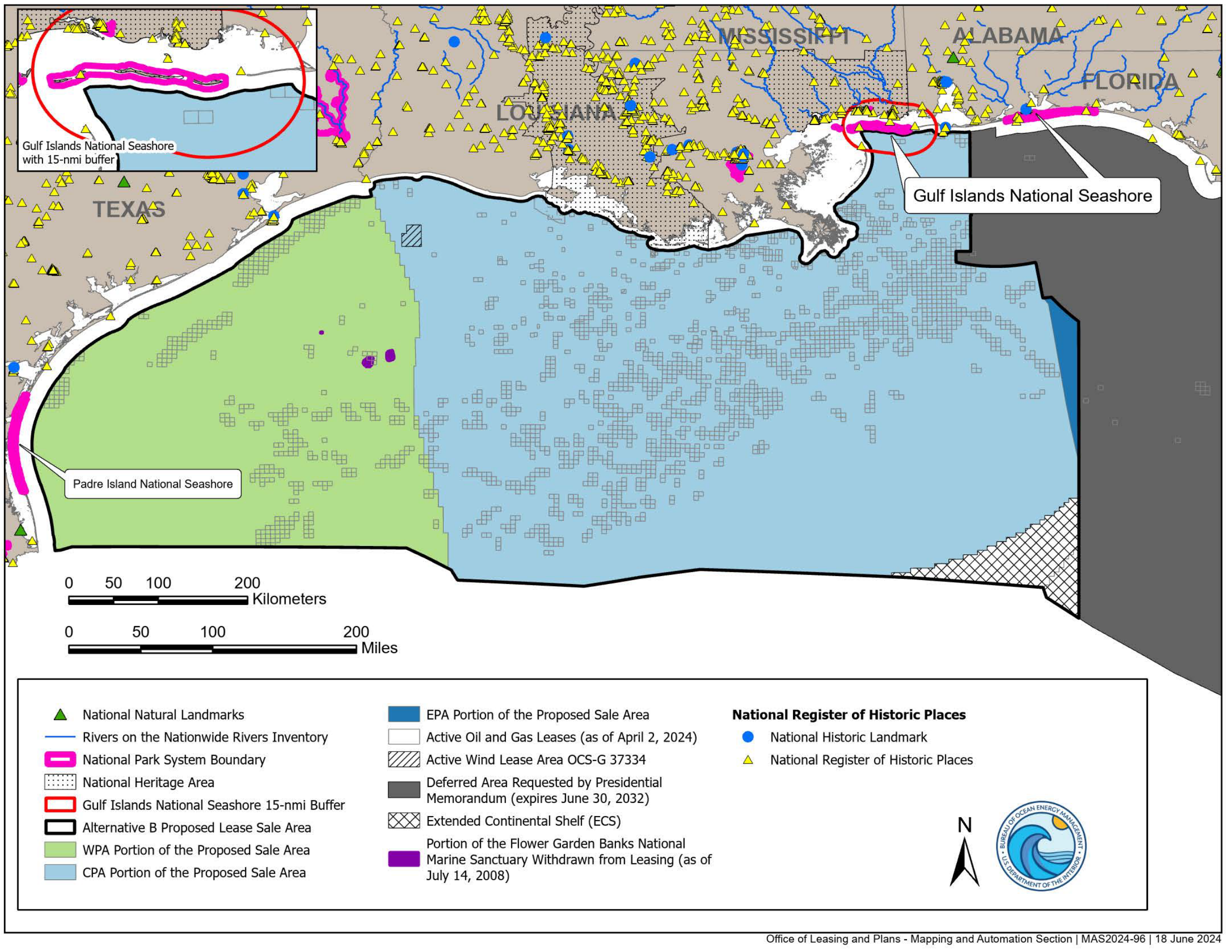

Figure 4.12-1. National Park Service Units and Other Program Areas Within or Near the Area of Analysis.

Climate change-related effects, such as sea-level rise; increasing temperatures; ocean acidification; coastal erosion/subsidence; more numerous, stronger tropical storms and hurricanes; and severe flooding events continue to influence the baseline conditions for recreational resources (Carter et al. 2018; Fleming et al. 2018). Chapters 4.3.1 and 4.4.5 of the GOM Oil and Gas SID provide detailed descriptions of the above baseline conditions and the ongoing effects of natural processes and events such as habitat degradation, saltwater intrusion, sedimentation of rivers, sediment deprivation, river or rainfall flooding, barrier island migration and erosion, fish kills, and red tide.

4.12.2 Environmental Consequences

Recreational resources in the GOM are affected by existing environmental conditions, natural processes and phenomena, and human-induced factors. Chapter 4.4.5 of the GOM Oil and Gas SID did not identify any programmatic concerns influencing recreational resources. There are also several OCS oil- and gas-related activities and non-OCS oil- and gas-related activities that have the potential to impact recreational resources (**Table 4.12-1**). BOEM conducted an initial screening of potential IPFs in the GOM Oil and Gas SID and determined that air emissions and pollution, bottom disturbance, coastal land use/modification, lighting and visual impacts, offshore habitat modification/space use, socioeconomic changes and drivers, unintentional releases into the environment, response activities, strikes and collisions, and climate change could potentially impact recreational resources. These IPFs and their potential to affect recreational resources are discussed below and in greater detail in Chapter 4.4.5 of the GOM Oil and Gas SID. Supporting rationale for IPFs that were not analyzed in detail in this Programmatic EIS can also be found in Chapter 4.4.5 of the GOM Oil and Gas SID. New information released since the development of the GOM Oil and Gas SID and relevant to the analysis is included in the applicable chapters below.

Table 4.12-1. Impact-Producing Factors with the Potential to Impact Recreational Resources.

OCS Oil- and Gas-Related Routine Activities	OCS Oil- and Gas-Related Accidental Events	Non-OCS Oil- and Gas-Related Activities
Bottom Disturbance	Unintended Releases into the Environment	Bottom Disturbance
Offshore Habitat Modification/ Space Use	Response Activities	Discharges and Wastes
Lighting and Visual Impacts	Strikes and Collisions	Coastal Land Use/Modification
Air Emissions and Pollution	-	Lighting and Visual Impacts
Coastal Land Use/Modification	-	Offshore Habitat Modification/ Space Use
Socioeconomic Changes and Drivers	-	Air Emissions and Pollution
-	-	Socioeconomic Changes and Drivers
-	-	Climate Change

There are several existing regulatory programs to reduce or minimize the environmental effects of these IPFs to recreational resources in the GOM and are enforced by BOEM, BSEE, and other agencies. The *Gulf of Mexico OCS Regulatory Framework* technical report (BOEM 2020a) overviews the complex interconnected regulatory regime that exists around GOM activities. Lessees are required to perform OCS oil- and gas-related activities in accordance with regulatory requirements; therefore, the analysis factors in the mitigating effects of all applicable regulatory requirements when making impact determinations.

Table 4.12-2. Existing Regulatory Requirements and Protective Measures That Reduce Potential Impacts of the Impact-Producing Factors.

Regulatory Requirement or Mitigating Measure	Enforcing Agency	Impact-Producing Factor(s) Reduced/Avoided	Supporting References and Sections
30 CFR § 551.6 – Obligations and rights under a permit or a notice	BOEM	Air Emissions and Pollution, Bottom Disturbance, Discharges and Wastes, Offshore Habitat Modification/Space Use	Chapter 6 of the GOM Oil and Gas SID
Magnuson-Stevens Fishery Conservation and Management Act	NOAA	Bottom Disturbance	Chapter 4.4.3 of the GOM Oil and Gas SID

Regulatory Requirement or Mitigating Measure	Enforcing Agency	Impact-Producing Factor(s) Reduced/Avoided	Supporting References and Sections
Air quality reviews of all site-specific plans for compliance with NAAQS through the OCSLA	BOEM	Air Emissions and Pollution – CAPs only	Chapter 5.6 of the GOM Oil and Gas SID, 30 CFR part 550
International Convention for the Prevention of Pollution from Ships (MARPOL) Annex VI and the Act to Prevent Pollution from Ships (APPS)	USEPA, USCG	Air Emissions and Pollution – CAPs only	33 U.S.C. §§ 1901-1915 – Prevention of Pollution from Ships
Air quality permits for compliance with Section 328 of the Clean Air Act*	USEPA	Air Emissions and Pollution – CAPs and HAPs only	40 CFR part 55
Oil Pollution Act of 1990	USCG, USEPA, DOT, DOI	Unintended Releases into the Environment, Response Activities	Chapters 2.9.2, 2.9.3, and 5.13.3 of the GOM Oil and Gas SID
Energy Policy Act of 2005 – Section 388	BOEM	Bottom Disturbance, Offshore Habitat Modification/Space Use	Chapter 2.5.2 of the GOM Oil and Gas SID
Blocks South of Baldwin County, Alabama, Stipulation	BOEM	Lighting and Visual Impacts	Chapter 4.4.5.1 of the GOM Oil and Gas SID
Marine Debris Research, Prevention, and Reduction Act	NOAA, USCG	Unintended Releases into the Environment	Chapter 4.4.5.2.3 of the GOM Oil and Gas SID
Marine Plastic Pollution Research and Control Act	USEPA, NOAA, USCG	Unintended Releases into the Environment	Chapter 4.4.5.2.3 of the GOM Oil and Gas SID
MARPOL-Annex V Treaty	USCG	Unintended Releases into the Environment	Chapter 4.4.5.2.3 of the GOM Oil and Gas SID

*Only for activities in the Eastern Planning Area (east of longitude 87.5 degrees).

4.12.2.1 OCS Oil- and Gas-Related Impact-Producing Factors from Routine Activities

Air Emissions and Pollution: Air emissions, like those from routine OCS oil- and gas-related activities, can affect visibility and aquatic and terrestrial resources (USFS et al. 2010). These air emissions and pollution contribute to the degradation of recreational destinations such as habitats of culturally and economically significant species, and damage of cultural and archaeological resources. The Breton Wilderness Area—part of the National Wilderness Preservation System—is the closest Federal Class 1 air quality sensitive area to OCS oil- and gas-related activities in the GOM region (Figure 4.1.1-1 of the GOM Oil and Gas SID). Air emissions could pose a persistent effect on recreational resources if people choose not to visit areas due to poor air quality. However, air emissions and pollution from routine offshore activities and onshore oil and gas infrastructure are regulated and monitored for compliance with the NAAQS. National parks and Federal wilderness areas' (e.g., Breton Wilderness Area) air quality and AQRVs are protected more stringently than under the NAAQS as discussed in **Chapter 4.1**.

Bottom Disturbance: Bottom disturbances, such as structure installations, can enhance recreational opportunities in the GOM by providing hard substrate in areas where only sandy bottom existed before. Alternatively, sediment disturbance and increased turbidity from these installations can smother marine life and negatively affect recreational fishing. Similar sediment disturbance and increased turbidity occur during structure decommissioning, if not retained as an artificial reef.

Coastal Land Use/Modification: Coastal land use/modification can cause minimal impacts to recreational resources though it is unlikely that new coastal infrastructure would be necessary to support OCS oil- and gas-related activities due to the amount of existing support infrastructure. If new infrastructure is developed in a previously undeveloped space, however, recreational resources could be negatively affected by the reduction of land available for these activities. Negative aesthetic effects may be experienced by recreators viewing wildlife, boating, or fishing in areas where OCS oil- and gas-related ports, navigational fairways, and support industry are located. However, even if a recreational space was lost to coastal OCS oil and gas infrastructure in a particular location, it is likely that a number of substitute recreational sites could be available nearby. Also, any land use changes would largely depend upon local zoning and economic trends.

Lighting and Visual Impacts: Lighting and visual impacts contribute positively and negatively to recreational resources. The visibility of OCS vessel traffic and platforms can affect the aesthetics of recreational experiences in certain areas. These effects depend on the type of recreational area, the extent to which vessel traffic and platforms are visible, and the subjective opinion of the viewer. The extent to which a platform is visible depends on various factors, including but not limited to, distance, elevation, size, location, weather and atmospheric conditions, air pollution, the curvature of the Earth, lighting, and the viewer’s expectations and perceptions (Bounds 2012). The size and location of an offshore structure depends on the reservoir being tapped, characteristics of the well-stream fluid, and the type of processing needed to treat the hydrocarbons.

Negative effects of offshore lighting from OCS oil- and gas-related activities could include a diminished sky-viewing experience at recreational sites, including protected areas, along the Gulf Coast. For example, Bounds (2012) offers evidence that oil and gas development near Dauphin Island (Alabama) caused negative effects to tourism. The visibility of oil and gas structures near Texas and Louisiana appear to have more limited (and in some cases positive) effects (Nassauer and Benner 1984; NPS 2001), although visual impacts from platforms arising from OCS oil- and gas-related activities could be subjective depending on the location and people in question, as preferences vary among recreators. The OCS oil- and gas-related activities occur farther from shore than State oil and gas activities, and thus would generally cause less visual impact for nearshore and onshore recreators than State oil and gas activities.

Currently leased blocks south of Baldwin County, Alabama, are subject to a stipulation aimed at minimizing visual impacts from oil and gas development. It requires that the lessee contact other lessees and operators of leases in the vicinity to determine if existing surface production structures can be shared. If the lessee cannot formulate a development scenario that does not require new surface structures, the lessee should ensure that the new structures use orientation or other design measures intended to limit their visibility from the shore.

Horn and Petit Bois Islands are federally designated wilderness areas and are sensitive to disruptions to nature experiences. For example, the NPS has expressed concern regarding the impacts from OCS oil- and gas-related platforms on the sky-viewing experiences on these islands, particularly at night. For these reasons, the NPS also requested during scoping that BOEM consider a no-leasing area within 15 nmi (17 mi; 28 km) of the Gulf Islands National Seashore.[11] However, potential impacts to Horn and Petit Bois Islands are directly addressed by BOEM's Gulf Islands National Seashore Information to Lessees (ITL), which notifies bidders that post-lease plans submitted by lessees of blocks within 12 mi (19 km) of Federal waters may be subject to additional review in order to minimize visual impacts from development operations. It is unlikely that a production platform would be installed near Horn and Petit Bois Islands in the foreseeable future due to a lack of remaining oil or gas reserves in unleased blocks within 10 mi (16 km) of the islands (Burgess et al. 2021). Furthermore, if there were a block(s) leased near Horn or Petit Bois Island, it would likely be developed using minimal structures that tie back to existing platforms due to cost considerations. Therefore, it is unlikely that a production platform would arise near Horn and Petit Bois Islands. In the unlikely event that any blocks are leased within the first 12 mi (19 km) of Federal waters south of the Gulf Islands National Seashore, BOEM would follow the Gulf Islands National Seashore ITL to coordinate with the NPS and the States of Mississippi and/or Alabama during its review of any post-lease development plans. Because of their distance from OCS oil- and gas-related activities, lighting and visual impacts to other NPS park units and managed areas are expected to be avoided or minimal.

Offshore Habitat Modification/Space Use: Offshore habitat modification from structure installations and removals can impact recreational resources by providing hard substrate in areas where only sandy bottom existed before. The OCS oil and gas structure installations can enhance recreational opportunities such as fishing and diving in the Gulf of Mexico (Hiett and Milon 2002). The positive effects of platforms could be reversed at decommissioning unless a platform is maintained as an artificial reef through a State's Rigs-to-Reefs program. Space-use conflicts can be caused by OCS oil- and gas-related vessel traffic navigating in the same areas as recreational vessels. However, OCS oil- and gas-related vessels move between onshore support bases (which are typically not near recreational areas) and production areas far offshore, while recreational vessels typically navigate closer to shore, with the exception of recreators that utilize offshore platforms.

There can be other space-use conflicts between recreational activities and OCS oil- and gas-related activities. Brody et al. (2006) present an analysis of space-use conflicts using a GIS-based framework to identify specific locations off the Texas coast where conflicts between oil activities and other concerns (including recreational use) are most acute. The study found that recreational use conflicts tend to be concentrated around the major wildlife viewing and beach areas near the larger population areas. Other potential space-use conflicts in the GOM include those areas near ports, along coastal Louisiana due to the high concentration of OCS oil and gas industry activities in this

[11] More information on the National Park Service comments can be found in the scoping report online at https://www.boem.gov/environment/environmental-assessment/gulf-mexico-regional-ocs-oil-and-gas-programmatic.

area. However, even if a space-use conflict was to arise in a particular instance, it is likely that a number of substitute recreational sites would be available.

Socioeconomic Changes and Drivers: Socioeconomic changes and drivers related to OCS oil- and gas-related activities have the potential to minimally increase or decrease the demand for recreational resources in certain communities. Increased demand for recreational resources has the potential to attract new recreational firms to a community, boosting the local economy; however, increased demand also has the potential to lessen the enjoyment of a particular resource by some community members. Since coastal infrastructure is well established and not prone to rapid fluctuations, existing oil and gas infrastructure will be sufficient to handle demand associated with ongoing routine OCS oil- and gas-related activities. Additionally, there is adequate undeveloped land in the analysis area to handle any new development, so a disturbance to an existing recreational site resulting from future development would be unlikely.

4.12.2.2 OCS Oil- and Gas-Related Impact-Producing Factors from Accidental Events

Unintended Releases into the Environment: Unintended spills can negatively impact recreational resources. The impacts of drilling fluid spills and chemical spills on recreational resources are not discussed in detail because of their small sizes and far distances from recreational resources. An oil spill that remains offshore can cause closures that may affect recreational fishing, diving, and boating. An oil spill can have more direct impacts on tourism and recreational areas if it reaches coastal areas, such as the contamination of beaches, killing of marine life, and diminishment of aesthetic quality. The impacts of an oil spill depend on the size of the spill, as well as the success of any associated containment and cleanup operations. An offshore oil spill can also impact nearby coastal areas through media coverage or through misperceptions and uncertainty regarding the extent of the spill. Following the *Deepwater Horizon* oil spill, the U.S. Government instituted substantial new safeguards to protect the environment beyond what had ever existed. These new safety measures include heightened drilling safety standards to reduce the chances of unintended releases in the first place, as well as a new focus on containment capabilities in the event of an oil spill (refer to Chapter 5.13 of the GOM Oil and Gas SID).

Marine debris from OCS oil- and gas-related vessels and facilities could reach beaches and other coastal resources, which could affect the aesthetics of these areas. The discharge of marine debris is subject to a number of laws and treaties, including the Marine Debris Research, Prevention, and Reduction Act; the Marine Plastic Pollution Research and Control Act; and the MARPOL-Annex V Treaty. These laws and treaties reduce the potential impacts to recreational resources from the discharge of marine debris from OCS operations.

Response Activities: Response activities can impact recreational resources to some extent, depending on the techniques deployed, location, and duration, as well as the success of the containment and cleanup operations following an oil spill. Oiled beach regions and the resulting cleanup effort can cause reduced visits to beaches and use of recreational areas. On the other hand, restaurants and hotels in the spill-response area could receive an influx of demand from cleanup workers that could offset losses otherwise expected from tourism declines resulting from a spill. No spill-response activities may be necessary if accidental spills are small or if they occur far enough offshore and weather before reaching shorelines.

Strikes and Collisions: A collision with a recreational boat could occur and could lead to damages, injuries, lost wages, and other effects for the boat operator and other persons involved. Vessel collisions may also disrupt recreational activities offshore and along the coast, as they could restrict waterway access for other boaters. If a bridge, pier, or other structure is hit, the transportation of goods, services, and people to and from recreational sites may be disrupted. The severity of the effects would depend on the duration and extent of the event. The effects from vessel collisions could be compounded if they encumbered a seasonal event, such as a coastal festival or fishing tournament. The effects of vessel strikes and collisions on recreational fishing is discussed in **Chapter 4.11**.

4.12.2.3 Alternatives Analysis

Alternative A – No Action (Cancellation of a Single Proposed OCS Oil and Gas Lease Sale)

Under Alternative A, a proposed OCS oil and gas lease sale would not occur, so there would be no new routine activities or accidental events resulting from the proposed action. Therefore, no direct impacts to recreational resources would occur as a result of the proposed action (i.e., a proposed oil and gas lease sale), including any potential beneficial effects from structure emplacement. Any indirect effects on recreation and tourism from energy substitution due to cancellation of a single OCS oil and gas lease sale would likely be **negligible**. Though an increase in energy-related activities on land or nearshore could potentially make some areas less attractive for recreation and tourism, any noticeable increase in energy-related activities on land to replace foregone activities from cancellation of a single proposed oil and gas lease sale is highly unlikely given the well-developed and extensive existing oil and gas industry and infrastructure in the region. Furthermore, cancellation of a single proposed OCS oil and gas lease sale would not be expected to cause any noticeable changes in coastal land use patterns given the expansive existing OCS Oil and Gas Program and the reasonably foreseeable future oil and gas lease sales anticipated over the next 10 years.

There are ongoing OCS oil- and gas-related activities and other non-OCS oil- and gas-related activities, however, that contribute to the baseline environment (summarized in **Chapter 4.0.1** of this Programmatic EIS and described in detail in Chapter 3 of the GOM Oil and Gas SID) that also affect recreational resources and would still occur. Ongoing activities associated with previous OCS oil and gas lease sales (**Table 3.3-2**) could still have potential direct impacts to recreational resources through air emissions and pollution, bottom disturbance, coastal land use/modification, lighting/visual impacts, offshore habitat modification/space use, socioeconomic changes and drivers, unintended releases into the environment, response activities, and strikes and collisions as summarized above in **Chapter 4.12.2.2** and evaluated as part of the cumulative analysis in **Chapter 4.17.12**.

Comparison of Impacts under Alternatives B, C, and D

A regionwide OCS oil and gas lease sale under Alternatives B-D, and the resulting OCS oil- and gas-related activities from any subsequent leases from the lease sale, would result in air emissions and pollution, bottom disturbance, coastal land use/modification, lighting and visual impacts, OCS offshore habitat modification/space use, socioeconomic changes and drivers, unintentional releases into the environment, response activities, and strikes and collisions that could potentially impact recreational resources.

Alternative B represents the largest geographic area under consideration for a regionwide lease sale. Alternatives C and D represent geographical constraints on available acreage for leasing, which could change the spatial distribution of the scenario activities but not the types of activities or overall activity levels. Therefore, this comparison of alternatives focuses on the potential environmental impacts of a regionwide lease sale (Alternative B) and then considers if these potential impacts could be reduced by the geographic constraints under Alternatives C and D.

Table 4.12-3 shows the impact determinations for each IPF potentially affecting recreational resources for each action alternative analyzed. For lighting and visual impacts, the impact levels are shown both with and without BOEM's proposed Blocks South of Baldwin County, Alabama, Stipulation applied. The impacts of Alternative A are not shown in **Table 4.12-3** because an oil and gas lease sale would not occur and the impacts for all IPFs from the proposed action would be **none**.

Table 4.12-3. Impact Determinations for Routine and Accidental Impacts to Recreational Resources for Alternatives B-D.

Impact-Producing Factor	BOEM's Protective Measure	Alternative B	Alternative C	Alternative D
Air Emissions and Pollution	N/A	**Negligible**	**Negligible**	**Negligible**
Bottom Disturbance	N/A	**Minor**	**Minor**	**Negligible**
Coastal Land Use/Modification	N/A	**Negligible**	**Negligible**	**Negligible**
Lighting and Visual Impacts	Without	**Minor Beneficial** to **Minor Adverse**	**Minor Beneficial** to **Minor Adverse**	**Negligible**
Lighting and Visual Impacts	With	**Minor Beneficial** to **Minor Adverse**	**Minor Beneficial** to **Minor Adverse**	**Negligible**
Offshore Habitat Modification/ Space Use	N/A	**Minor Beneficial**	**Minor Beneficial**	**Negligible**
Socioeconomic Changes and Drivers	N/A	**Minor Beneficial** to **Minor Adverse**	**Minor Beneficial** to **Minor Adverse**	**Negligible**
Unintended Releases into the Environment	N/A	**Minor**	**Minor**	**Negligible**
Response Activities	N/A	**Negligible**	**Negligible**	**Negligible**
Strikes and Collisions	N/A	**Negligible**	**Negligible**	**Negligible**

Note: Alternative A is not shown in the table because the impacts from all impact-producing factors would be **none**, and indirect impacts from the alternative would be **negligible**.

Alternative B – Regionwide OCS Lease Sale

Alternative B considers a regionwide lease sale area under the scenario described in **Chapter 3**. Within this geographic area, impacts from air emissions and pollution are expected to be **negligible** given the level of activity expected in **Chapter 3** and existing air quality regulations for offshore oil and gas operations under 30 CFR part 550, 40 CFR part 55, and the International Convention for the Prevention of Pollution from Ships (MARPOL) Annex VI and the Act to Prevent Pollution from Ships (APPS) (33 U.S.C §§ 1901-1915).

Bottom Disturbance: Impacts from bottom disturbance are expected to be **minor adverse** due to increased turbidity resulting from the expected level of installation and decommissioning activities of platforms, pipelines, and other seafloor infrastructure (**Chapter 3**). These negative impacts are likely to be short-term and localized, meaning recreational fishing would be minimally affected.

Coastal Land Use/Modification: Impacts from coastal land use/modification are expected to be **negligible**, as the development of new coastal oil and gas infrastructure is unlikely (**Chapter 3**). Furthermore, in the rare case of new infrastructure development or expansion of existing infrastructure, substitute recreational sites would likely make up for the reduction of opportunity elsewhere.

Lighting and Visual Impacts: The relative additional contribution of light pollution resulting from new OCS oil- and gas-related activities, as detailed in **Chapter 3**, could alter how the night sky and natural seascape are perceived by recreators, which could result in reductions in visitation and less desirable visitor experiences at affected sites (e.g., wilderness designated parks). Potential impacts from lighting and visual impacts could be positive or negative, and often subjective depending on the location and preferences of the viewer in question. Some recreators may find the contrast provided by OCS oil and gas platforms to be appealing, while others may see them as detrimental to their viewing experience. For example, Horn and Petit Bois Islands are federally designated wilderness areas and are sensitive to disruptions to nature experiences. In the unlikely event that a block were leased near Horn or Petit Bois Island, it would likely be developed using minimal structures that tie back to existing platforms due to cost considerations. This is possibly the case for many future OCS projects in areas visible from shore. BOEM's Information to Lessees and Operators issued at each regional lease sale allows for consultation with the States of Mississippi and/or Alabama and the National Park Service on a lessee's post-lease OCS development plans related to visibility concerns in lease blocks near the Gulf Islands National Seashore.

Regardless, OCS oil- and gas-related activities occur farther from shore than State oil and gas activities, and thus may cause less visual impact for nearshore and onshore recreators than State oil and gas activities. Furthermore, the stipulation for blocks south of Baldwin County, Alabama, aims to limit visual disturbances from oil and gas structures. Without the stipulation, it is possible that heightened visual impacts would occur from newly installed oil and gas structures south of Baldwin County, Alabama. Because of their distance from OCS oil- and gas-related activities, lighting and visual impacts to other NPS park units and managed areas (**Figure 4.12-1**) are expected to be avoided or negligible. As a result of the limited spatial extent of the stipulation, overall impacts from lighting and visual impacts are expected to be **minor beneficial** to **minor adverse** with or without the application of the Blocks South of Baldwin County, Alabama, Stipulation; however, light and visual impacts would be reduced in the area covered by the stipulation.

Offshore Habitat Modification/Space Use: Impacts from offshore habitat modification/space use are expected to be **minor beneficial**, given the levels of activity described in **Chapter 3** and the aforementioned benefits to recreational fishing and diving arising from artificial habitat provided by offshore oil and gas platforms. These effects are expected to occur across the leased area, where oil and gas platforms are established, and last beyond the life of the oil and gas operations if maintained as artificial habitat. In addition, given the extensive existing OCS oil and gas industry along the Gulf Coast, it is unlikely that OCS oil- and gas-related activity from a single proposed oil and gas lease sale would substantially add to space-use conflicts. Any potential disruption of recreational vessel activity would likely be temporary.

Socioeconomic Changes and Drivers: Impacts from socioeconomic changes and drivers can be expected to be both positive and negative. On the negative side, increased demand in the area can result in the expansion of urbanized development into current recreational sites. But on the positive end, increased development could favor additional investment in tourism and recreational infrastructure (such as lodging and restaurants). However, since coastal infrastructure is well established and not prone to rapid fluctuations, existing oil and gas infrastructure would likely be sufficient to support future activity (**Chapter 3**) associated with a proposed oil and gas lease sale with no noticeable increase in disruptions to recreational resources. Thus, overall impacts from socioeconomic changes and drivers are expected to be **minor beneficial** to **minor adverse**.

Unintended Releases into the Environment: Impacts from unintended releases into the environment can negatively affect recreational fishing, diving, and boating. For oil spills, given the spill sizes and probabilities described in **Chapter 3.5.1**, most adverse impacts would likely be short term and localized, with larger spills closer to shore more likely to affect recreational resources than spills farther offshore. People may also choose not to visit areas with known or visibly poor air quality as a result of an unintended release, as it may affect their health and enjoyment of the visit. Media coverage of a spill could also have negative effects on nearby coastal areas covered by the media, resulting in disproportionate reductions in recreational activity. Because of their distance from OCS oil- and gas-related activities, oil-spill impacts to most NPS park units and managed areas are expected to be avoided or minimal. As outlined in **Table 4.12-2**, there are several existing regulatory programs and requirements in place that would reduce or minimize the environmental effects of unintended releases resulting from the proposed action. For example, the likelihood and severity of oil spills would be mitigated by the Oil Pollution Act and the requirement that newly constructed tankers use double-hulled containments. Furthermore, oil and chemical spills arising from routine OCS oil- and gas-related activities are typically small and localized, leaving numerous substitute recreational areas available. Thus, impacts from unintended releases into the environment are expected to be **minor adverse**.

Response Activities: In the unlikely event of a large oil spill near recreational resources, oiled beach regions and the resulting cleanup effort could cause reduced visits to beaches and use of recreational areas, depending on the location and cleanup methods deployed (e.g., *in-situ* burning). As evidenced by the large oil spill that occurred off the coast of Louisiana on November 16, 2023, in many cases even larger oil spills do not contact the shoreline. As of February 2024 there has been no reported use of dispersants during response activities (NOAA 2023a) and there have been no reported wildlife or shoreline impacts (USCG 2023); however, investigation of the spill is ongoing. Impacts from response activities are thus expected to be **negligible** given the likely small, localized scope of unintended releases near recreational resources (**Chapter 3.5.1**), low level of necessary response activity, and low likelihood of impacting existing recreational resources.

Strikes and Collisions: Impacts from strikes and collisions can negatively affect the recreationists directly involved in the collision, as well as those indirectly affected by restrictions to recreational access produced by the direct impacts, both of which are unlikely to occur given the distance between common recreational locations and oil and gas operations. Given this low likelihood, impacts from strikes and collisions are expected to be **negligible**.

Based on the description of the IPFs above and the scenario projections for a single oil and gas lease sale provided in **Chapter 3**, the overall impacts from IPFs associated with Alternative B from routine OCS oil- and gas-related activity on recreational resources would be **minor beneficial** to **minor adverse**. Additionally, impacts from IPFs from accidental events on recreational resources would be **minor adverse**.

Alternative C – Inflation Reduction Act Targeted OCS Lease Sale Area

Alternative C aims to concentrate leasing activities into a smaller footprint to potentially reduce impacts to ecologically sensitive areas and to preserve additional flexibility for marine spatial planning. These geographic constraints could change the spatial distribution of activities when compared to Alternative B but would not be expected to meaningfully change the types of activities or their overall levels. Therefore, based on the description of the IPFs above and the scenario projections for a single oil and gas lease sale provided in **Chapter 3**, the overall impacts from IPFs associated with Alternative C from routine OCS oil- and gas-related activity on recreational resources would be **minor beneficial** to **minor adverse**, similar to those under Alternative B. Additionally, impacts from accidental events on recreational resources would be **minor adverse**, although the removal of the wind energy areas, SSRAs, and other blocks (**Figure 2.2.3-1**) could reduce the probability of some accidental events being experienced in adjacent recreational areas, especially in Texas and western Louisiana.

Alternative D – Targeted OCS Lease Sale Area with Additional Exclusions

Due to the removal of much of the lease sale area from the recreational area near the coastline, the IPFs from the oil and gas leasing under Alternative D would result in **negligible** impacts, both from routine oil- and gas-related activity and accidental events.

Therefore, based on the description of the IPFs above and the scenario projections for a single proposed OCS oil and gas lease sale provided in **Chapter 3**, the overall impacts from IPFs associated with Alternative D from routine OCS oil- and gas-related activity on recreational resources would be **negligible**. Additionally, adverse impacts from IPFs from accidental events on recreational resources would be **negligible**.

4.12.3 Incomplete or Unavailable Information

BOEM has identified incomplete or unavailable information regarding the full likelihood of impacts on recreational resources from Alternatives B and C. In particular, the likelihood of impacts from routine OCS oil- and gas-related activity are not fully known, given that much of the recreational activity occurs near the coastline. BOEM has determined that such information is not essential to a reasoned choice among alternatives because much of this uncertainty relates to the inherent uncertainty regarding where (and what types) of structures would arise from a representative oil and gas lease sale. In addition, existing information allows for sufficient and reasonable estimates of the overall impacts given these constraints. BOEM used generally accepted scientific principles to best estimate the impacts of each proposed action, including literature sources, data sources, and photographic evidence. Therefore, the incomplete or unavailable information, while relevant, would not substantially change the impact conclusions reached in this analysis and is not essential to a reasoned choice among alternatives.

4.13 CULTURAL, HISTORICAL, AND ARCHAEOLOGICAL RESOURCES

Archaeological resources are any material remains of human life or activities that are at least 50 years of age and that can provide a scientific or humanistic understanding of past human behavior, cultural adaptation, and related topics. Archaeological sites are non-renewable resources that, once lost, cannot be regenerated. The National Historic Preservation Act of 1966 (NHPA), as amended (54 U.S.C. § 300101), includes archaeological resources among potential “historic properties,” defined as any prehistoric or historic district, site, building, structure, or object included on, or eligible for inclusion on, the National Register of Historic Places (NRHP), including artifacts, records, and material remains relating to the district, site, building, structure, or object (54 U.S.C. § 300308). In some cases, the term “cultural resources” covers a wider range of resources than “historic properties,” such as sacred sites, archaeological sites not eligible for the National Register of Historic Places, and archaeological collections (CEQ and ACHP 2013). Traditional cultural properties and sacred sites also may be designated as historic properties.

4.13.1 Affected Environment

Archaeological resources on the OCS are categorized under one of two general designations: pre-contact or historic. Pre-contact archaeological resources refer to Native American archaeological sites or artifacts that date prior to the arrival of Europeans in North America beginning in the late 15th century C.E. (Common Era). It includes sites that are now submerged on the OCS but that were associated with the first humans to occupy areas of the Gulf Coast at least 14,500 years ago (Halligan et al. 2016).

Historic archaeological resources on the Gulf of Mexico OCS consist of shipwrecks and aircraft. BOEM has identified over 2,000 known or reported shipwrecks on the Gulf of Mexico OCS with at least 40 documented shipwrecks having been determined eligible or potentially eligible for listing on the NRHP (BOEM 2021d). The actual locations of reported shipwrecks may not be accurately described in archival records, and the existing records are not inclusive of all potential historic shipwrecks that may be located on the OCS. Submerged shipwrecks off the coasts of Texas, Louisiana, Mississippi, and Alabama are likely to be moderately well-preserved because of the high sediment load in the water column from upland drainage and wind and water erosion.

4.13.2 Environmental Consequences

Cultural, historical, and archaeological resources in the GOM are affected by existing environmental conditions, natural processes and phenomena, and human-induced factors. Chapter 4.5 of the GOM Oil and Gas SID describes the relevant programmatic concerns, which include major storm events (e.g., hurricanes), seafloor mudslides, and sedimentation from upland drainage. In the GOM, it is almost certain that many existing shipwrecks on the OCS have been, or can be, affected by major storm events and hurricanes, primarily due to storm surge and seabed shifting. Shipwrecks occurring in shallow water nearer to shore have been reworked and scattered by subsequent storms more often than those wrecks occurring at greater depths on the OCS. Similar patterns would be expected for future major storm events as well.

There are several OCS oil- and gas-related activities and non-OCS oil- and gas-related activities that have the potential to impact cultural, historical, and archaeological resources (**Table 4.13-1**). BOEM conducted an initial screening of IPFs in the GOM Oil and Gas SID and determined that air emissions and pollution, discharges and wastes, bottom disturbance, coastal land use/modification, lighting and visual impacts, and accidental events (i.e., unintended releases into the environment, response activities, and strikes and collisions) could potentially impact cultural, historical, and archaeological resources (**Table 4.13-1**). These IPFs and their potential to affect cultural, historical, and archaeological resources are discussed below and in greater detail in Chapter 4.5.2 of the GOM Oil and Gas SID. Supporting rationale for IPFs that were not analyzed in detail in this Programmatic EIS can also be found in Chapter 4.5.2 of the GOM Oil and Gas SID. New information released since the development of the GOM Oil and Gas SID and relevant to the analysis is included in the applicable chapters below.

Table 4.13-1. Impact-Producing Factors with the Potential to Impact Cultural, Historical, and Archaeological Resources.

OCS Oil- and Gas-Related Routine Activities	OCS Oil- and Gas-Related Accidental Events	Non-OCS Oil- and Gas-Related Activities
Air Emissions and Pollution	Unintended Releases into the Environment	Air Emissions and Pollution
Discharges and Wastes	Response Activities	Discharges and Wastes
Bottom Disturbance	Strikes and Collisions	Bottom Disturbance
Coastal Land Use/Modification	-	Coastal Land Use/Modification

OCS Oil- and Gas-Related Routine Activities	OCS Oil- and Gas-Related Accidental Events	Non-OCS Oil- and Gas-Related Activities
Lighting and Visual Impacts	-	Lighting and Visual Impacts
-	-	Climate Change

There are several existing regulatory programs and requirements in place to reduce or avoid the environmental effects of these IPFs to archaeological resources in the GOM. For example, pursuant to 30 CFR § 550.194, BOEM's archaeologists review all agency-permitted activities for their potential to affect archaeological resources and, when appropriate, take steps in coordination with lessees to avoid, minimize, or mitigate any adverse effects. Regulatory requirements enforced by BOEM and BSEE are outlined in **Table 4.13-2** and further described in the *Gulf of Mexico OCS Regulatory Framework* technical report (BOEM 2020a). Lessees are required to perform OCS oil- and gas-related activities in accordance with all regulatory requirements; therefore, this analysis factors in the mitigating effects of all applicable regulatory requirements when making impact determinations.

Table 4.13-2. Existing Regulatory Requirements and Protective Measures That Reduce the Potential Impacts of Impact-Producing Factors.

Regulatory Requirement or Protective Measure[1]	Enforcing Agency	Impact-Producing Factor(s) Reduced/Avoided	Supporting References and Sections
30 CFR § 550.194 – Reporting and Avoidance Requirements	BOEM, BSEE	Bottom Disturbance, Discharges and Wastes	Chapters 4.5 and 5.9 of the GOM Oil and Gas SID
30 CFR § 551.6 – Obligations and rights under a permit or a Notice	BOEM	Bottom Disturbance, Discharges and Wastes	Chapters 4.5, 5.2.5, and 5.9 of the GOM Oil and Gas SID
30 CFR § 250.1727 – What information must I include in my final application to remove a platform or other facility	BSEE	Bottom Disturbance, Discharges and Wastes	Chapters 4.5, 5.2.5, 5.2.7.4, and 5.9 of the GOM Oil and Gas SID
Sections 106 and 110 of the National Historic Preservation Act	ACHP	Bottom Disturbance, Discharges and Wastes	Chapters 4.5 and 5.9 of the GOM Oil and Gas SID

[1] Refer to Chapter 6 of the GOM Oil and Gas SID for conditions of approval commonly applied at the post-lease stage.

4.13.2.1 OCS Oil- and Gas-Related Impact-Producing Factors from Routine Activities

Air Emissions and Pollution: Air emissions and pollution from routine oil and gas operations contribute to carbon dioxide and other pollutants in the atmosphere and may be a contributing factor to acidic deposition, ocean acidification, and eutrophication in the Gulf of Mexico (Caldeira and Wickett 2003; Driscoll et al. 2003a; Howarth 2008; Paerl et al. 2002; Vitousek et al. 1997; Wanninkhof et al. 2015). Based on the analysis of terrestrial resources, archaeological resources can deteriorate faster in higher acidic environments (Al-Hosney and Grassian 2005; Baedecker et al. 1992; Winkler 1970). Conversely, the deterioration of submerged shipwreck materials is typically slowed in low oxygen or anoxic conditions. Air emissions and pollution from routine OCS oil and gas operations must comply with BOEM and USEPA air quality regulations. Air quality reviews would be conducted to determine if the projected air emissions proposed in site-specific plans meet or exceed certain thresholds and, if necessary, identify appropriate emissions controls to mitigate or prevent unreasonable air quality degradation.

Discharges and Wastes: Discharges and wastes, such as drilling muds and cuttings, released from routine OCS oil- and gas-related operations can physically impact the seafloor through sediment, trace metal, and hydrocarbon deposition. These discharges can place trace metals, hydrocarbons, and suspended materials within several acres around the drilling location (Continental Shelf Associates Inc. 2004a), which could potentially alter an archaeological site's formation processes through physical, chemical, or biological disruption of its localized environment as described under "Bottom Disturbance" below. Discharges are only allowed if the requirements of the CWA and the corresponding NPDES permit are met, including no unreasonable degradation of the environment as discussed in Section 403 of the CWA (USEPA 2023b). Furthermore, compliance with the regulatory requirements under 30 CFR § 550.194, including avoidance mitigation to prevent physical damage to archaeological resources, would inherently reduce the likelihood of routine discharges and wastes occurring near archaeological resources.

Bottom Disturbance: Bottom disturbance from routine OCS oil- and gas-related activities represents the primary source of potential negative impacts to archaeological resources. These potential effects include removal, reorientation, and/or destruction of the artifact assemblage or other physical components of an archaeological site, inhibiting the proper identification and interpretation of the site as a result. Bottom-disturbing activities could result in the complete destruction of a submerged pre-contact archaeological site or an inability to accurately resolve the site in subsequent remote-sensing surveys. If severe enough, this loss of archaeological information may minimize site integrity and prevent a determination of the site's eligibility to the NRHP or reverse a previous determination of eligibility. In all cases, these negative effects are permanent.

An indirect negative effect from bottom disturbance is a disruption of the localized environmental conditions, which may accelerate the degradation of an archaeological site. As parts of a shipwreck are buried in oxygen-deprived sediments and as ferrous objects become encrusted in a protective concretion of iron mixed with sand and shell, the shipwreck reaches a relative state of equilibrium with its surrounding environment. Once natural or anthropogenic events alter the environmental conditions, then this state of equilibrium is also disrupted and can expose the site to further degradation. For this reason, indirect consequences from a bottom-disturbing event are likely to continue long after the initial event.

To fulfill the requirements of Section 106 of the NHPA (36 CFR part 800) and BOEM's regulations (30 CFR § 550.194), BOEM's archaeologists review all agency-permitted activities for their potential to affect historic properties and, when appropriate, take steps in coordination with operators to avoid, minimize, or mitigate any adverse effects. These steps include conducting geophysical surveys of the operator's area of potential effect to locate potential archaeological resources and requiring avoidance of potential resources or, if avoidance is not possible, further investigation to document their NRHP eligibility. Sites are located with the assistance of geophysical surveys under the supervision of a qualified marine archaeologist. If the site is found to be potentially eligible for listing in the NRHP, further avoidance will be prioritized. If avoidance is not possible, alternate mitigating measures, including but not limited to archaeological data recovery operations, will be designed in coordination with applicable State Historic Preservation Offices, Tribal Historic Preservation Offices, and the Advisory Council on Historic Preservation. If an archaeological resource is unexpectedly discovered during an operator's bottom-disturbing activities, BOEM requires operators to halt those activities and report the discovery to BOEM and BSEE to receive further instructions on how to protect the discovery prior to resuming activities. Typical mitigating measures require either avoidance or further investigation to determine appropriate avoidance distances of potential shipwrecks or submerged landforms with the potential for Native American site preservation. Additionally, during project reviews, BOEM archaeologists recommend buffers around known and potential shipwreck locations to avoid disturbance to these locations. From 2020 to 2024, BSEE has documented only four instances where an inadvertent event (e.g., anchor placement) may have contacted an archaeological resource (Bleichner 2024, official communication), suggesting that BOEM's recommended avoidance measures are effective at reducing the risk of bottom disturbance to these resources.

Coastal Land Use/Modification: Coastal land disturbances associated with routine OCS oil and gas development may result from the expansion or installation of coastal infrastructure such as oil and gas service bases, waste disposal facilities, gas processing plants, pipeline landfalls, and navigation channels. These disturbances may occur on land or in the marine environment, and their potential impacts to archaeological sites and other historic properties would be a result of their associated ground or seafloor disturbances or from restricted access to traditional cultural properties. These activities would be subject to applicable State laws and regulations, including potential review by the relevant State Historic Preservation Office. Activities for which BOEM is the lead Federal agency or a cooperating agency for NHPA and NEPA would also be subject to additional coordination and consultation between BOEM and the relevant State, Tribe(s), and other consulting parties in fulfillment of Section 106 of the NHPA. However, as noted in **Chapter 3.4.5**, existing onshore oil and gas infrastructure is expected to be sufficient to handle activities associated with a proposed action. While an oil and gas lease sale and subsequent OCS oil- and gas-related activity would contribute to the continued need for maintenance dredging of existing navigation channels, a mature network of navigation channels already exists in the analysis area; therefore, new navigation channel construction as a direct result of a single proposed oil and gas lease sale is not likely (Dismukes 2011).

Lighting and Visual Impacts: Coastal historic property types that may have a setting dependent upon the surrounding seascape include lighthouses, fortifications, historic resorts, personal residences, and traditional cultural properties. These same property types, and others, may have inland-facing viewsheds that are not solely dependent on the maritime landscape. Offshore oil and gas infrastructure is generally not considered to have visual impacts to coastal archaeological, cultural, and historic sites as offshore oil and gas infrastructure has existed on the Gulf of Mexico OCS since the 1940s. Additionally, offshore oil and gas infrastructure pre-dates the NHPA and, therefore, any coastal historic property currently listed on the NRHP would not derive its eligibility from an unobstructed view of the GOM.

4.13.2.2 OCS Oil- and Gas-Related Impact-Producing Factors from Accidental Events

The accidental event IPFs that affect cultural, historical, and archaeological resources are unintended releases into the environment, response activities, and strikes and collisions. Detailed descriptions of the potential impacts from these IPFs are provided in Chapter 4.5.2.3 of the GOM Oil and Gas SID and are summarized here.

Unintended Releases into the Environment: Unintended releases into the environment could impact a cultural, historic, or archaeological site if the accidental release directly contacts the resource and alters its localized physical, chemical, or biological environment, thereby putting the site in disequilibrium with its surroundings and accelerating site decomposition (Hamdan et al. 2018; Mugge et al. 2019). Research has also shown that both chemical and biological degradation/deterioration of wood "reduces its mechanical and physical properties" (Chang et al. 2002). Over time and given the right environmental conditions, waterlogged wood often becomes increasingly fragile (Jordan 2001). A study of wood in terrestrial environments has suggested that, while wood degradation is initially delayed by contamination with crude oil, at later stages it is accelerated (Ejechi 2003). Marine trash and debris may also damage an archaeological site and its associated artifacts and result in a loss of diagnostic information or introduce modern material that masks the acoustic or magnetic signature of the archaeological site in remote-sensing surveys.

Response Activities: Spill-response activities such as dispersant use, chemical cleaning agents, mechanical removal, and exposure to oil itself could affect cultural, historic, and archaeological resources. Following the 2010 *Deepwater Horizon* oil spill in the Gulf of Mexico, Salerno et al. (2018) documented that the release of hydrocarbons and chemical dispersant in marine environments may affect the structure of benthic microbial communities and biofilms found on artificial substrates, such as historic shipwrecks. That study indicated that exposure to oil and dispersant could disrupt the composition and metabolic function of biofilms colonizing metal hulls, potentially compromising the environmental equilibrium of the shipwreck and accelerating corrosion processes.

Spill-response activities may also impact coastal archaeological sites, including contamination of artifacts, ecofacts, and samples, with the potential to distort the results of archaeometric dating techniques, including radiocarbon dating and pottery residue analysis. Rees et al. (2019) assessed the effects of the 2010 *Deepwater Horizon* oil spill on eight precontact archaeological sites on Louisiana's Gulf Coast. Crude oil and dispersant used during the response were detected in redeposited shoreline middens and intact archaeological contexts. Effects to dating the artifacts were shown that they could be mitigated with a solvent-extraction process prior to testing. Spill-response impacts to coastal archaeological sites may additionally occur from associated bottom disturbances. For example, the major impacts to coastal archaeological sites from the *Exxon Valdez* spill in Alaska in 1989 were related to cleanup activities, such as the construction of helipads, roads, and parking lots, and to looting by cleanup crews, rather than from the oil itself (Bittner 1996).

Strikes and Collisions: According to BSEE data, from 2008 to 2019 there were 160 OCS oil- and gas-related vessel collisions in the GOM (Mathews 2020). Once they occur, accidental vessel strikes and collisions by their nature cannot be mitigated. Impacts to shipwrecks from vessel collisions could include direct physical damage to the resource from collision debris or secondary impacts from the release of pollutants that contact the shipwreck as described above in “Bottom Disturbance” and “Unintended Releases into the Environment.”

4.13.2.3 Alternatives Analysis

The impact-level definitions in **Table 4.13-3** build upon and refine those initially introduced in **Table 4.0-4**. The impact levels for cultural resources are defined by the degree to which their historical integrity would be impaired if OCS oil- and gas-related activities associated with the proposed action would alter any of the characteristics that qualify them for listing in the NRHP.

Table 4.13-3. Negative Impact-Level Definitions for Cultural Resources by Type.

Impact Level	Historic Properties under Section 106 of the NHPA	Archaeological Resources and Ancient Submerged Landform Features	Historic Built/Onshore Resources
Negligible	No historic properties affected, as defined at 36 CFR § 800.4(d)(1).	A. No cultural resource subject to potential impacts from ground- or seabed-disturbing activities; or B. All disturbances to cultural resources are fully avoided, resulting in no damage to or loss of scientific or cultural value from the resources.	A. No measurable impacts; or B. No physical impacts and no change to the integrity of resources or visual disruptions to the historic or aesthetic settings from which resources derive their significance; or C. All physical impacts and disruptions are fully avoided.
Minor	No adverse effects on historic properties could occur, as defined at 36 CFR § 800.5(b). This can include avoidance measures.	A. Some damage to cultural resources from ground- or seabed-disturbing activities, but there is no loss of scientific or cultural value from the resources; or B. Disturbances to cultural resources are avoided or limited to areas lacking scientific or cultural value.	A. No physical impacts (e.g., alteration or demolition of resources) and some limited visual disruptions to the historic or aesthetic settings from which resources derive their significance; or B. Disruptions to historic or aesthetic settings are short term and expected to return to an original or comparable condition (e.g., temporary vegetation clearing and construction vessel lighting).

Impact Level	Historic Properties under Section 106 of the NHPA	Archaeological Resources and Ancient Submerged Landform Features	Historic Built/Onshore Resources
Moderate	Adverse effects on historic properties as defined at 36 CFR § 800.5(a)(1) could occur. Characteristics of historic properties would be altered in a way that diminishes the integrity of the property's location, design, setting, materials, workmanship, feeling, or association, but the adversely affected property would remain eligible for the NRHP.	As compared to minor impacts: A. Greater extent of damage from ground- or seabed-disturbing activities, including some loss of scientific or cultural data; or B. Disturbances to cultural resources are minimized or mitigated to a lesser extent, resulting in some damage to and loss of scientific or cultural value from the resources.	As compared to minor impacts: A. No or limited physical impacts and greater extent of changes to the integrity of cultural resources or visual disruptions to the historic or aesthetic settings from which resources derive their significance; or B. Disruptions to settings are minimized or mitigated; or C. Historic or aesthetic settings may experience some long-term or permanent impacts.
Major	Adverse effects on historic properties as defined at 36 CFR § 800.5(a)(1) could occur. Characteristics of historic properties would be affected in a way that diminishes the integrity of the property's location, design, setting, materials, workmanship, feeling, or association to the extent that the property is no longer eligible for listing in the NRHP.	As compared to moderate impacts: A. Destruction of or greater extent of damage to cultural resources from ground- or seabed-disturbing activities; or B. Disturbances are minimized or mitigated but do not reduce or avoid the destruction or loss of scientific or cultural value from the cultural resources; or C. Disturbances are not minimized or mitigated, resulting in the destruction or loss of scientific or cultural value from the resources.	As compared to moderate impacts: A. Physical impacts on cultural resources (e.g., demolition of a cultural resources onshore); or B. Greater extent of changes to the integrity of cultural resources or visual disruptions to the historic or aesthetic settings from which resources derive their significance, including long-term or permanent impacts; or C. Disruptions to settings are not minimized or mitigated.

Alternative A – No Action (Cancellation of a Single Proposed OCS Oil and Gas Lease Sale)

Under Alternative A, a proposed lease sale would not occur, so there would be no new routine activities or accidental events resulting from the proposed action. Therefore, no direct or indirect impacts to cultural, historical, and archaeological resources would occur from the proposed action (i.e., a proposed oil and gas lease sale). However, there are ongoing OCS oil- and gas-related activities and other non-OCS oil- and gas-related activities that contribute to the baseline environment (summarized in **Chapter 4.0.1** of this Programmatic EIS with more detail in Chapter 3 of the GOM Oil and Gas SID) that would still occur. Ongoing activities associated with previous OCS oil and gas lease sales (**Table 3.3-2**) could still have potential direct impacts to cultural, historical, and archaeological resources through air emissions and pollution, discharges and wastes, bottom disturbance, coastal land use/modification, lighting/visual impacts, offshore habitat modification/space use, unintended releases into the environment, response activities, and strikes and collisions as summarized above in **Chapter 4.13.2.2** and evaluated as part of the cumulative analysis in **Chapter 4.17.13**.

An indirect consequence of the cancellation of a lease sale would be an incremental reduction in the discovery of potential OCS archaeological resources. Archaeological surveys conducted in support of oil and gas exploration and development activities has been the primary means through which BOEM has identified known and potential archaeological resources on the Gulf of Mexico OCS. The cessation of future surveys in unleased and unexplored areas could limit BOEM's awareness of the presence or absence of potential archaeological resources in unleased blocks and, consequently, the information that would be available to other Federal and State agencies to inform the protection of those resources during non-OCS oil- and gas-related activities or during response activities associated with accidental events.

Comparison of Impacts under Alternatives B, C, and D

A regionwide lease sale under Alternatives B through D, and the resulting OCS oil- and gas-related activities from any subsequent leases, would result in air emissions and pollution, discharges and wastes, bottom disturbance, coastal land use/modification, lighting and visual impacts, and accidental events that could potentially impact cultural, historical, and archaeological resources. Alternative B represents the largest geographic area under consideration for a regionwide lease sale. Alternatives C and D represent geographical constraints on available acreage for leasing that could change the spatial distribution of the scenario activities but not their overall activity levels. Therefore, this alternatives analysis is focused on the potential environmental impacts of a regionwide lease sale (Alternative B) and then considers if these potential impacts could be reduced or altered by the geographic constraints under Alternatives C and D.

Table 4.13-4 shows the impact determinations for each IPF that affects cultural, historical, and archaeological resources for each action alternative analyzed. The impacts of Alternative A are not shown in **Table 4.13-4** because an oil and gas lease sale would not occur and the impacts for all IPFs from the proposed action would be avoided.

Table 4.13-4. Impact Determinations for Routine and Accidental Impacts to Cultural, Historical, and Archaeological Resources for Alternatives B-D.

Impact-Producing Factor	BOEM's Protective Measure[1]	Alternative B	Alternative C	Alternative D
Air Emissions and Pollution	N/A	**Negligible**	**Negligible**	**Negligible**
Discharges and Wastes	N/A	**Negligible** to **Minor**	**Negligible** to **Minor**	**Negligible** to **Minor**
Bottom Disturbance	N/A	**Negligible** to **Minor**	**Negligible** to **Minor**	**Negligible** to **Minor**
Coastal Land Use/ Modification	N/A	**Negligible** to **Minor**	**Negligible** to **Minor**	**Negligible** to **Minor**

Impact-Producing Factor	BOEM's Protective Measure[1]	Alternative B	Alternative C	Alternative D
Lighting and Visual Impacts	N/A	**Negligible** to **moderate**	**Negligible** to **moderate**	**Negligible** to **moderate**
Unintended Releases into the Environment	N/A	**Negligible** to **Major**	**Negligible** to **Major**	**Negligible** to **Major**
Response Activities	N/A	**Negligible** to **Minor**	**Negligible** to **Minor**	**Negligible** to **Minor**
Strikes and Collisions	N/A	**Negligible** to **Major**	**Negligible** to **Major**	**Negligible** to **Major**

Note: Alternative A is not shown in the table because the impacts from all impact-producing factors would be **none**.

[1] No programmatic protective measures for application at the OCS lease sale stage are being contemplated in this Programmatic EIS. All BOEM protective measures for archaeological resources would be considered and applied at the site-specific stage.

Alternative B – Regionwide OCS Lease Sale

Alternative B considers a regionwide lease sale area. Within this geographic area, the types of potential impacts from bottom disturbance, discharges and wastes, air emissions, and lighting and visual impacts to cultural, historical, and archaeological resources for routine activities under Alternative B would be the same as those described above in **Chapter 4.13.2.1**.

Bottom Disturbance: While there is the potential for up to major impacts to occur from bottom disturbance, with the implementation of required archaeological surveys and application of avoidance mitigations through existing regulations (refer to **Table 4.13-2**), the expected impacts to cultural, historical, and archaeological resources would be negligible to minor. Because the protective measures mentioned above scale to the geographic scope and activities associated with each alternative, there is not expected to be measurable differences among the alternatives in impacts to these resources from routine bottom disturbances.

Discharges and Wastes: Similarly, because the potential impacts from routine discharges and wastes would be in compliance with existing regulatory requirements, those impacts would be **negligible** to **minor**.

Air Emissions and Pollution: Impacts from air emissions and pollution would likely be **negligible** given the widespread distribution of emissions, their transient nature and distance from most archaeological features, and compliance with various regulatory standards for air quality to prevent unreasonable air quality degradation. In certain circumstances, eutrophication from air emissions could result in **negligible** to **minor beneficial** impacts to archaeological resources by decreasing overall oxygen levels in their vicinity. Preservation of archaeological materials is usually improved in lower oxygen environments. That said, while there may be limited benefits, they are relatively small when considered across the entire GOM, thus the overall beneficial effects are **negligible**.

Lighting and Visual Impacts: The introduction of new lighting sources or visible infrastructure is expected to have **negligible** to **moderate negative** impacts on coastal cultural, historic, or archaeological resources. This is largely due to two factors. First, given the extensive existing onshore infrastructure, new onshore infrastructure is not expected. Second, there is extensive offshore infrastructure already in place that provides a substantial baseline of lighting sources and visible infrastructure and, thus, the construction of any new offshore infrastructure would have a marginal incremental effect. Even with the substantial amount of infrastructure, though, the construction of a new platform in particular locations could have an adverse effect on the viewshed of a coastal historic property.

Unintended Releases into the Environment: The potential impacts to cultural, historical, and archaeological resources from accidental events under Alternative B would be the same as those described above in **Chapter 4.13.2.2**. The negative impacts from unintended releases would be **negligible** to **major**. More specifically, if the spatial extent of an unintended release is isolated and does not encroach the applied avoidance boundaries of known or potential archaeological resources, the negative impacts would be **negligible** to **minor**. If the unintended release comes into direct physical contact with an archaeological resource, then the potential for disturbances to the seafloor from unintended releases to cause localized, negative impacts to that resource could be **negligible** to **major**. Compared to planned bottom disturbances, which are mitigated through BOEM's post-lease permitting and approval processes, these seafloor disturbances from unintended releases inherently do not benefit from pre-planning and avoidance.

Response Activities: For response activities that involve seafloor or coastal/terrestrial bottom disturbances, the negative impacts to cultural, historical, and archaeological resources would be **negligible** to **minor**. If chemical dispersants come into direct physical contact with an archaeological resource, then the potential for bottom disturbance to cause localized, negative impacts to that resource is **negligible** to **major**.

Strikes and Collisions: Similarly, though guidance and communication practices reduce their likelihood, accidental vessel strikes and collisions do occasionally still occur, are essentially random, and inherently cannot be predicted or mitigated through planned avoidance. Thus, negative impacts to cultural resources from accidental collisions could be **negligible** to **major**. However, the likelihood of a vessel collision directly impacting a historic property is very low and BSEE did not report any such events within the past 5 years.

Based on the IPFs above, the projected activity levels for the proposed action as provided in **Chapter 3** and BOEM's existing regulatory requirements, the overall impact conclusion for routine activities on cultural, historical, and archaeological resources would be **negligible** to **minor**. If new platforms or infrastructure in particular locations are found likely to have an adverse effect on the viewshed of potentially NRHP eligible properties during review of an individual permit application, BOEM would conduct a site-specific Section 106 consultation to determine ways to minimize, mitigate, or avoid adverse effects to those historic properties where possible. Most reasonably foreseeable accidental events are expected to be highly localized, and adherence to archaeological survey requirements and avoidance mitigations, when applicable, should prevent or reduce most impacts. Therefore, the overall impacts from accidental events to archaeological resources is expected to be **negligible** to **minor**. However, where protective measures cannot be applied or adhered to and an accidental event comes into direct physical contact with an archaeological resource, negative impacts to that resource could be **negligible** to **major**. However, accidental events coming into direct contact with an archaeological resource is not common.

Alternative C – Inflation Reduction Act Targeted Lease Sale Area

Alternative C represents a geographical constraint on available acreage for leasing, which could cause a change in the spatial distribution of activities compared to Alternative B but not the types of activities or their overall levels. This potential spatial redistribution of activity would further reduce the potential to impact archaeological sites on the deferred lease blocks, but it would not result in a meaningful difference in the overall potential impacts to archaeological resources from routine activities or accidental events when compared to Alternatives B and D. Therefore, the impacts to cultural, historical, and archaeological resources from routine activities under Alternative C would be **negligible** to **minor** given the spatial extent of the projected activities and the existing regulatory requirements (**Table 4.13-2**). Impacts from accidental events to cultural, historical, and archaeological resources would be **negligible** to **minor** when mitigating measures can be utilized or **negligible** to **major** when mitigating measures cannot be utilized.

Alternative D – Targeted Lease Sale Area with Additional Exclusions

Alternative D represents a geographical constraint on available acreage for leasing, which could cause a change in the spatial distribution of activities compared to Alternative B or C but not the types of activities or their overall levels. This potential spatial redistribution of activity would further reduce the potential to impact archaeological sites on the deferred lease blocks, but it would not result in a meaningful difference in the overall potential impacts to cultural, historical, and archaeological resources from routine activities or accidental events when compared to Alternatives B and C. Therefore, the impacts to cultural, historical, and archaeological resources from routine activities under Alternative D would be **negligible** to **minor** given the spatial extent of the projected activities and the existing regulatory requirements (**Table 4.13-2**). Impacts from accidental events to cultural, historical, and archaeological resources would be **negligible** to **minor** when mitigating measures can be utilized or **negligible** to **major** when mitigating measures cannot be utilized.

4.13.3 Incomplete or Unavailable Information

There is incomplete and unavailable information on the location and baseline characteristics of archaeological resources on the OCS and the long-term effects associated with climate change-related factors. BOEM has determined that such information is not essential to a reasoned choice among alternatives because comprehensive knowledge of the long-term effects of climate change to cultural, historical, and archaeological resources cannot be obtained within the timeframe analyzed in this Programmatic EIS and because the impact conclusions described above are identical across all alternatives and are not dependent on the incomplete or unavailable information. The incremental contribution of the proposed action to future effects from climate change, under any of the action alternatives, is not expected to be detectible or noticeable when compared to climate change effects under the no action alternative. Furthermore, BOEM's archaeological survey requirements are expected to be effective in identifying the locations of potential archaeological resources that may be present in any individual leased area. Therefore, the incomplete or unavailable information, while relevant, would not be expected to change the impact conclusions and is not essential to a reasoned choice among alternatives.

4.14 LAND USE AND COASTAL INFRASTRUCTURE

Land use is a term used to describe the human use of land for economic and cultural activities. For planning purposes, it can be broadly divided into six general categories: transportation, recreation, agriculture, residential, commercial, or industrial uses. Coastal infrastructure along the Gulf Coast can fall into any number of these land use categories, however, for purposes of more efficiently bounding this analysis, the term coastal infrastructure used here refers only to *onshore* oil- and gas-related infrastructure that provides support for offshore OCS oil- and gas-related activities. The broader notion of infrastructure as systems is included in the consideration of land use. This delineation makes sense because this type of coastal infrastructure serves as both an IPF for other resources (**Chapter 3.4.5**) and also as a resource that is impacted by routine OCS oil- and gas-related activities, accidental events, and non-OCS oil- and gas-related activities as these coastal infrastructure types support other interests unrelated to OCS oil- and gas-related activities. While it is not feasible to adequately cover all of the infrastructure systems in such a large area, it is feasible and logical to focus on OCS oil- and gas-related infrastructure that positively and negatively affects onshore populations. Refer to **Chapters 4.10, 4.11, 4.12, 4.16, and 4.15** for more discussions of the affected environments for and impacts to onshore resources.

4.14.1 Affected Environment

There are 133 counties and parishes that constitute 23 BOEM-identified Economic Impact Areas (EIAs) along the Gulf Coast States (**Chapter 4.15**). **Figure 4.14-1** shows the primary economic land uses within the 133 counties and parishes that constitute the EIAs. This geographic area is diverse in the types of land use and distribution of coastal infrastructure. In addition to homes, condominiums, and some industry, this coastline supports one of the major recreational regions of the United States, particularly for fishing and beach activities. The coastal zone includes miles of recreational beaches and an extended system of barrier islands. It also has a deepwater port, oil and gas support industries, manufacturing, farming, ranching, and hundreds of thousands of acres of wetlands and protected habitat.

Oil and gas exploration, production, and development activities on the OCS are supported by an expansive onshore network of coastal infrastructure that includes large and small companies providing a wealth of services from construction facilities, service bases, and waste disposal facilities to crew, supply, and product transportation, as well as processing facilities. As a long-standing part of the regional economy that developed over several decades, the coastal infrastructure network is mature in the Gulf of Mexico region. For example, Port Fourchon is a major onshore staging area for

OCS oil- and gas-related activities in the GOM, and it is the headquarters of the Louisiana Offshore Oil Port (LOOP), which offloads 10-15 percent of U.S. foreign oil imports. The LOOP is the only U.S. deepwater port that is able to offload very large crude carriers and ultra-large crude carriers (LOOP LLC 2020). Port Fourchon also services over 95 percent of deepwater GOM production, over 400 services vessels per day use the port and up to 1,200 trucks per day come and go from Port Fourchon (Greater Lafourche Port Commission 2020).

4.14.2 Environmental Consequences

Chapter 4.4.1 of the GOM Oil and Gas SID describes programmatic concerns influencing land use, including coastal resource-dependent industries, land-use patterns, coastal land loss, marine trash and debris, and climate change. In addition, **Chapter 4.4.1** describes land uses in the GOM coastal states and OCS oil- and gas-related coastal infrastructure, including construction facilities, support facilities, and transportation and processing facilities. Onshore oil- and gas-related infrastructure provides support for offshore OCS oil- and gas-related activities, serving as **both** an impact-producing factor **for** other resources (refer to **Chapter 3**) and also as a resource that is impacted **by** OCS oil- and gas-related activities, accidental events, and non-OCS oil- and gas-related activities.

Several OCS oil- and gas-related activities and non-OCS oil- and gas-related activities have the potential to impact land use and coastal infrastructure (**Table 4.14-1**). BOEM conducted an initial screening of IPFs in the GOM Oil and Gas SID and determined that discharges and wastes, coastal land use/modification, lighting and visual impacts, socioeconomic changes and drivers, and accidental events (unintended releases into the environment, response activities, and strikes and collisions) could potentially impact land use and coastal infrastructure. These IPFs and their potential to affect land use and coastal infrastructure are discussed below and in greater detail in Chapter 4.4.1 of the GOM Oil and Gas SID. Supporting rationale for IPFs that were not analyzed in detail in this Programmatic EIS can also be found in Chapter 4.4.1 of the GOM Oil and Gas SID. New information released since the development of the GOM Oil and Gas SID and relevant to the analysis is included in the applicable chapters below.

Table 4.14-1. Impact-Producing Factors with the Potential to Impact Land Use and Coastal Infrastructure.

OCS Oil- and Gas-Related Routine Activities	OCS Oil- and Gas-Related Accidental Events	Non-OCS Oil- and Gas-Related Activities
Discharges and Wastes	Unintended Releases into the Environment	Discharges and Wastes
Coastal Land Use/Modification	Response Activities	Coastal Land Use/Modification
Lighting and Visual Impacts	Strikes and Collisions	Lighting and Visual Impacts
Socioeconomic Changes and Drivers	-	Offshore Habitat Modification/ Space Use
-	-	Socioeconomic Changes and Drivers
-	-	Natural Processes
-	-	Climate Change

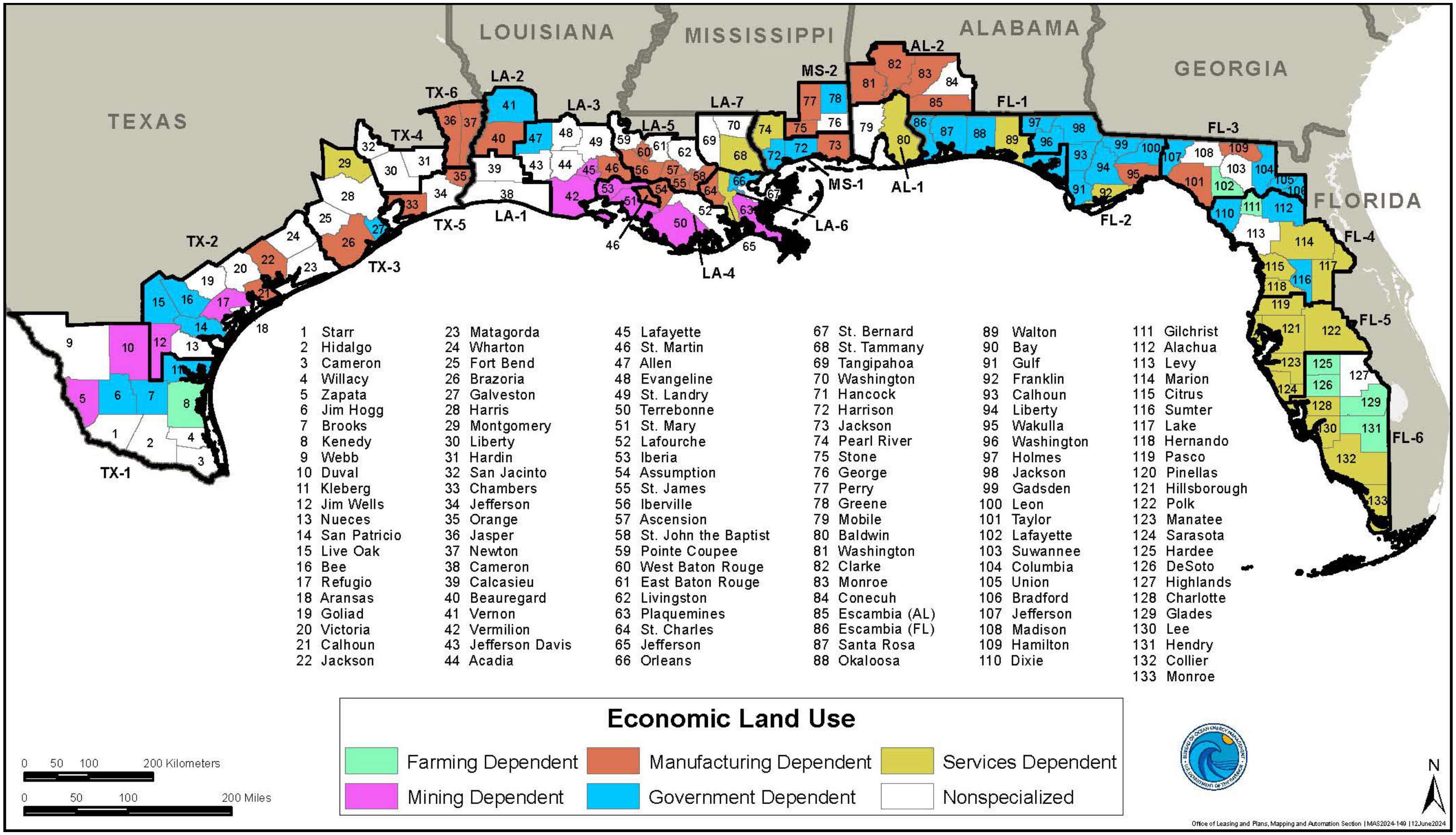

Figure 4.14-1. Economic Land Use in the Gulf of Mexico Region.

It is important to note that the onshore analysis area, spanning 133 counties and parishes across five Gulf Coast States, is regulated by many local, State, and Federal laws and regulations from local zoning ordinances to State environmental and natural resource regulations and Federal laws and regulatory requirements. This vast regulatory and legal framework serves to reduce potential impacts to land use and coastal infrastructure.

4.14.2.1 OCS Oil- and Gas-Related Impact-Producing Factors from Routine Activities

***Discharges and Wastes*:** Discharges and wastes from OCS oil- and gas-related activities can directly and indirectly impact land use and coastal infrastructure. Onshore disposal of wastes generated from OCS oil and gas facilities contribute to the potential for expansion of capacity at onshore waste facilities. The volume of OCS waste generated is closely correlated with the level of offshore drilling and production activity (Dismukes et al. 2007). If expansion of an existing facility or construction of a new waste facility were to occur, this could cause localized expansion of economies (i.e., increased demand for services, consumer spending, and indirectly, new employment). These positive impacts would be localized, short-term, limited in nature and offset by the increased risk of unwanted discharges. If activity levels decrease, then the opposite impact occurs. Decreases in demand for services could negatively affect local and possibly regional economies. The OCS oil- and gas-related activity levels fluctuate based on changes in demand, commodity prices, and offshore service vessel day rates (for shipyards, shipbuilding, and transportation services). Additionally, the potential exists for land use and coastal infrastructure to be negatively impacted by unauthorized discharges from onshore support facilities in violation of the Clean Water Act, which could contribute to pollution issues and potential groundwater contamination.

***Coastal Land Use/Modification*:** The OCS oil- and gas-related activities drive demand for onshore support infrastructure and contribute to any land-use changes that may occur as a result of these activities, such as current operations at OCS oil- and gas-related infrastructure including construction facilities (e.g., fabrication yards, pipecoating plants), support facilities (e.g., ports, service vessels), and processing facilities, (e.g., natural gas processing and refineries). Coastal land use modifications contribute both negatively and positively to land use and coastal infrastructure impacts. For example, ports associated with OCS oil- and gas-related activities are important components of industrial activities that can positively affect land use and coastal infrastructure by contributing to and supporting the local and regional economies. Ports are a vital path for the various supply chains that support OCS oil- and gas-related activities. Activity at ports and associated transportation can positively affect the economy. Conversely, when modifications of port facilities are required (e.g., dredging to allow for deeper draft vessels or development of additional acreage for support facilities), these can negatively affect surrounding land use by reducing available habitat for species harvested by subsistence and recreational hunters and fishers or by building on agricultural or recreational areas (**Chapter 4.12**).

***Lighting and Visual Impacts*:** Visual impacts can affect land use in coastal areas by detracting from or enhancing the intended use and enjoyment of private and public properties along the coast. Offshore OCS oil- and gas-related lighting could minimally affect land use by diminishing the visual aesthetics for some recreational sites by detracting from some nature experiences. However, because aesthetics can be subjective, platform lighting can also have some minimal positive effects on land use by improving visibility of the platforms and adding contrast to the landscape. Discussion of potential visual impacts to recreational resources is provided in **Chapter 4.12** of this Programmatic EIS with more detail in Chapter 4.4.5 of the GOM Oil and Gas SID.

***Socioeconomic Changes and Drivers*:** Socioeconomic changes and drivers that may negatively or positively affect land use and coastal infrastructure are connected indirectly to oil and gas operations as demonstrated by changes in the levels of OCS oil- and gas-related activities. These socioeconomic drivers of OCS oil- and gas-related activity levels include fluctuations in oil and natural gas prices; economic shifts on local, state, national and global levels; fluctuations in the gross domestic product; rising or decreasing corporate profits; supply chain effects; local, State, and Federal government revenue; changes in government regulations and policies at all levels; labor demands; skilled workforce shortages; and variations in global market supply and demand. Higher activity levels increase demand for services, which can affect land use if a facility needs to acquire additional land for expansion to meet the demand, and it could affect infrastructure facilities by potentially increasing profits and the need to hire additional employees. This would be a positive effect and could cause localized expansion of economies (i.e., increased demand for services, consumer spending, and indirectly, new employment), resulting in localized land-use changes including commercial and residential development and growth. However, land use may be negatively affected by a reduction in the availably of land for other types of development.

4.14.2.2 OCS Oil- and Gas-Related Impact-Producing Factors from Accidental Events

Unintended Releases into the Environment: Oil spills and chemical spills related to OCS oil- and gas-related activities could negatively affect land use and coastal infrastructure. The severity of these impacts would depend on the geographic location, volume spilled, duration, and type of oil or chemical. Reasonably foreseeable (non-catastrophic) offshore oil spills associated with the proposed action would normally volatilize and be dispersed by currents and therefore, would have a low probability of contacting and affecting coastal areas (Ji and Schiff 2023). Oil and chemical spills in coastal and inland waters, such as those resulting from the operations of offshore supply vessels, pipelines, barges, tanker ships, and ports, are more likely to negatively affect land use and coastal infrastructure. For example, if waterways are closed to traffic following a spill, this may result in effects to upstream and downstream business interests as it impedes the flow of commerce. Other potential effects from oil or chemical spills could include damages to private and public lands, personal injury, damages to collateral property (moveable property such as vehicles and boats), and economic damages from the disruption of business. The intensity of any effects related to a spill would be experienced inconsistently among businesses and residents, meaning it would be worse for some businesses/residents than others. For example, those who have alternative means of transporting their goods would not feel the effects of a spill as harshly as those who are most dependent on the affected waterway for transport. Impacts to land use and coastal infrastructure from coastal and offshore oil spills are variable and depend on the size and location of the spill.

Response Activities: Spill response may negatively or positively affect land use and coastal infrastructure. The influx of spill-response workers could contribute to filling short-term rental vacancies at hotels, apartments, and other properties that could provide housing, which could be a positive effect on land use and infrastructure, and by extension, the local economies. Conversely, the requisite needs for staging operations, equipment handling, and waste disposal could negatively impact land use by occupying land that would otherwise be available. Also, spill response generates large quantities of waste, and this can strain existing waste disposal capacity and increase the risk of solid and liquid waste being disposed of improperly, thereby generating negative effects for land use and coastal infrastructure. The potential impacts of spill-response activities on land use and coastal infrastructure would depend on the spill's location, duration, and whether the event is a small-scale spill (<1,000 bbl) or a larger spill (≥1,000 bbl); the larger the spill, the greater the impacts.

Strikes and Collisions: The majority of offshore vessel collisions involve service vessels colliding with platforms or pipeline risers, although sometimes vessels collide with each other. The collisions could result in the spilling of chemicals or oil, but offshore spills resulting from collisions do not typically affect coastal areas (**Chapter 3.5**). Vessel collisions in coastal waters may involve other vessels or stationary structures like bridges and docks. These collisions often result in spills of various substances, and spills in coastal waters can have adverse impacts to land use and coastal infrastructure, depending on the severity and location of a vessel collision, the size of the vessels involved, and whether the collision involves a bridge, pier, or other structure. Land use and coastal infrastructure are most likely to be affected when a collision involves a bridge, pier, or other structure, or when vessels collide in busy industrial waterways such as the Houston Ship Channel. These collisions negatively affect transportation (e.g., bridge traffic) and waterborne commerce when waterways are obstructed, and land uses in the area such as local businesses may be negatively affected.

4.14.2.3 Alternatives Analysis

Alternative A – No Action (Cancellation of a Single Proposed OCS Oil and Gas Lease Sale)

Under Alternative A, a proposed lease sale would not occur, so there would be no new routine activities or accidental events resulting from the proposed action. Therefore, no direct impacts to land use or coastal infrastructure would occur as a result of the proposed action (i.e., a single proposed oil and gas lease sale). Furthermore, because a regionwide lease sale would represent only 0.3 to 1.8 percent of the overall Cumulative OCS Oil and Gas Program production in the GOM (**Table 3.3-1**), cancellation of a single oil and gas lease sale would not be expected to result in a notable adverse or beneficial impact to coastal infrastructure. Given the existing infrastructure, the breadth of onshore and offshore oil and gas activity already utilizing coastal infrastructure, and the long-term projections for industry needs, coastal infrastructure in the GOM region is not prone to rapid fluctuations.

There are ongoing OCS oil- and gas-related activities and other non-OCS oil- and gas-related activities, however, that contribute to the baseline environment (summarized in **Chapter 4.0.1** of this Programmatic EIS with details in Chapter 3 of the GOM Oil and Gas SID) that also affect land use and coastal infrastructure and would still occur. Ongoing activities associated with previous OCS oil and gas lease sales (**Table 3.3-2**) could still have potential direct impacts to land use and coastal infrastructure through discharges and wastes, coastal land use/modification, lighting/visual impacts, socioeconomic changes and drivers, unintended releases into the environment, response activities, and strikes and collisions. Their potential impacts are summarized above in **Chapter 4.14.2.2** and evaluated as part of the cumulative analysis in **Chapter 4.17.14**.

Comparison of Impacts under Alternatives B, C, and D

A regionwide OCS oil and gas lease sale under Alternatives B through D, and the resulting OCS oil- and gas-related activities from any subsequent leases, would result in discharges and wastes, coastal land use/modification, lighting and visual impacts, socioeconomic changes/drivers, and accidental events that could potentially impact land use and coastal infrastructure. Alternative B represents the largest geographic area under consideration for a regionwide lease sale. Alternatives C and D represent geographical constraints on available acreage for leasing that could change the spatial distribution of the scenario activities, but not their overall activity levels. Therefore, this alternatives analysis is focused on the potential environmental impacts of a regionwide lease sale (Alternative B) and then considers if these potential impacts could be reduced or altered by the geographic constraints under Alternatives C and D.

Table 4.14-2 shows the impact determinations for the IPFs that could affect coastal land use and infrastructure for each action alternative analyzed. The impacts of Alternative A are not shown in **Table 4.14-2** because a proposed oil and gas lease sale would not occur, and the impacts for all IPFs from the proposed action would be avoided.

Table 4.14-2. Impact Determinations for Routine and Accidental Impacts to Coastal Land Use and Infrastructure for Alternatives B-D.

Impact-Producing Factor	BOEM's Protective Measure	Alternative B	Alternative C	Alternative D
Discharges and Wastes	N/A	**Minor Beneficial** to **Minor Adverse**	**Minor Beneficial** to **Minor Adverse**	**Minor Beneficial** to **Minor Adverse**
Coastal Land Use/Modification	N/A	**Minor Beneficial** to **Minor Adverse**	**Minor Beneficial** to **Minor Adverse**	**Minor Beneficial** to **Minor Adverse**
Lighting and Visual Impacts	N/A	**Negligible**	**Negligible**	**Negligible**
Socioeconomic Changes and Drivers	N/A	**Minor Beneficial** to **Minor Adverse**	**Minor Beneficial** to **Minor Adverse**	**Minor Beneficial** to **Minor Adverse**
Unintended Releases into the Environment	N/A	**Negligible** to **Moderate Adverse**	**Negligible** to **Moderate Adverse**	**Negligible** to **Moderate Adverse**
Response Activities	N/A	**Minor Beneficial** to **Moderate Adverse**	**Minor Beneficial** to **Moderate Adverse**	**Minor Beneficial** to **Moderate Adverse**
Strikes and Collisions	N/A	**Negligible** to **Moderate Adverse**	**Negligible** to **Moderate Adverse**	**Negligible** to **Moderate Adverse**

Note: Alternative A is not shown in the table because the impacts from all impact-producing factors is **none**.

Alternative B – Regionwide OCS Lease Sale

Discharges and Wastes: Onshore impacts from discharges and wastes could affect land use and coastal infrastructure in Texas, Louisiana, Mississippi, Alabama, or Florida, depending on which onshore waste facilities receive wastes from offshore activities. Louisiana and Texas, respectively, have the highest numbers of OCS-related waste facilities in the GOM region, and therefore, have a greater likelihood of being impacted than the other three Gulf Coast States. If any impacts were to occur, they are expected to range from **minor beneficial** to **minor adverse** for two reasons. First, existing regulatory requirements guide the appropriate handling and disposal of wastes, and the types and quantity of discharges allowed. These regulatory requirements are largely implemented by State and Federal agencies that have their own mitigation requirements that serve to avoid and reduce any impacts. Second, no new facilities or expansions of existing facilities are projected (**Chapter 3.4.5**), and the capacity at existing facilities is sufficient to handle wastes generated from ongoing routine OCS oil- and gas-related activities (Dismukes 2023). Impacts are largely minimal from a combination of no new expected facilities and an existing regulatory and mitigation framework and, thus, beneficial (e.g., dredged material disposal that reduces subsidence) or adverse impacts would be **minor**. For additional discussion, refer to **Chapter 4.1.2** of this Programmatic EIS and Chapter 4.4.1.2 in the GOM Oil and Gas SID.

Coastal Land Use/Modification: Impacts from coastal land use or modification vary depending on the type, scale, and location of the land use/modification. These impacts range from **minor beneficial** to **minor adverse** because coastal land use/modification contribute both negatively and positively to land use and coastal infrastructure impacts as described in **Chapter 4.1.2** of this Programmatic EIS and Chapter 4.4.1.2 of the GOM Oil and Gas SID. A regionwide OCS oil and gas lease sale represents only about 0.3 to 1.8 percent of the overall Cumulative OCS Oil and Gas Program production in the GOM (**Table 3.3-1**) and no new onshore facilities or expansions of existing facilities are projected, so most of these impacts would be secondary and small and include activities like dredging and maintenance at existing facilities.

Lighting and Visual Impacts: Visual impacts can affect land use and coastal infrastructure negatively and positively as described in **Chapter 4.1.2** of this Programmatic and Chapter 4.4.1.2 of the GOM Oil and Gas SID. However, these impacts would be **negligible** because they would not be measurable and particularly in the coastal areas where oil and gas activities occur (offshore Texas, Louisiana, Mississippi and Alabama), perception of impacts are subjectively interpreted by the observers. Additionally, State and Federal agencies with jurisdiction over facility siting have their own mitigation requirements that serve to avoid or reduce any impacts.

Socioeconomic Changes and Drivers: Socioeconomic changes and drivers could affect land use and coastal infrastructure in the Gulf Coast States as described in **Chapter 4.1.2** of this Programmatic EIS and Chapter 4.4.1.2 of the GOM Oil and Gas SID. These impacts are expected to range from **minor beneficial** to **minor adverse** because there may be some small and measurable benefits for employment, improvements to local infrastructure and community services (e.g., job creation, road/rail/port improvements, upgrading local parks and recreational areas), and there could be some adverse localized impacts that may disrupt uses temporarily (e.g., traffic disruption due to construction).

Unintended Releases into the Environment: Accidental events could affect land use and coastal infrastructure in the analysis area as discussed above in **Chapter 4.1.2** of this Programmatic EIS and Chapter 4.4.1.2 of the GOM Oil and Gas SID; impacts from unintended releases into the environment would range from **negligible** to **moderate adverse** depending on the size and location of the release. As noted in **Chapter 3.5.1.1**, the estimated number of spills decrease with increasing spill size. As such, most oil and chemical spills that do occur are small and dispersed which, when considered across the Gulf of Mexico, result in negligible to moderate impacts. Larger spills, while less likely (Ji and Schiff 2023), also disproportionately affect various communities across the GOM depending on the location of the spill. That said, similar to the smaller spills, these spills generally volatize and are dispersed by currents resulting in limited impacts to land use and coastal infrastructure.

Response Activities: Impacts from response activities would range from **minor beneficial** to **moderate adverse** depending on the type of activity and the onshore area affected (e.g., local businesses, beach recreation and space-use conflicts).

Strikes and Collisions: Impacts due to **collisions** would range from **negligible** to **moderate adverse** based on the nature of the accident and duration of the disruption to onshore activities.

Based on the description of the IPFs above and the scenario projections for a single oil and gas lease sale provided in **Chapter 3**, the overall impacts from IPFs associated with Alternative B on land use and coastal infrastructure would be **minor adverse**. Coastal infrastructure that supports offshore OCS oil- and gas-related activities is well established in the GOM region, and new or expanded infrastructure is not anticipated to support routine activities as a result of a single proposed OCS oil and gas lease sale. Furthermore, there are numerous State and Federal agencies that permit onshore facility siting and response activities to minimize effects routine activities and accidental events.

Alternative C – Inflation Reduction Act Targeted OCS Lease Sale Area

Alternative C represents a geographical constraint on available acreage for leasing, which could change the spatial distribution of activities when compared to Alternative B, but likely not the types of activities or their overall levels. This potential spatial redistribution of activity does not affect land use and coastal infrastructure because impacts to land use and coastal infrastructure are tied directly to the level of offshore activities, and a lease sale under Alternative C is not expected to alter the forecasted development activity (described in **Chapter 3**).

Therefore, based on the description of the IPFs above and the scenario projections for a single OCS oil and gas lease sale provided in **Chapter 3**, the overall impacts from IPFs associated with Alternative C on land use and coastal infrastructure would be **minor adverse**.

Alternative D – Targeted OCS Lease Sale Area with Additional Exclusions

Alternative D represents a geographical constraint on available acreage for leasing, which could change the spatial distribution of activities when compared to Alternative B or C, but likely not the types of activities or their overall levels. This potential spatial redistribution of activity does not affect land use and coastal infrastructure because impacts to land use and coastal infrastructure are tied directly to offshore activity levels, and a lease sale under Alternative D is not expected to alter the forecasted development activity (described in **Chapter 3**). The IPFs from routine activities are also unchanged from Alternative B.

Therefore, based on the description of the IPFs above and the scenario projections for a single oil and gas lease sale provided in **Chapter 3**, the overall impacts from IPFs associated with Alternatives D on land use and coastal infrastructure would be **minor adverse**.

4.14.3 Incomplete or Unavailable Information

BOEM has identified incomplete or unavailable information that may be relevant to reasonably foreseeable impacts on land use and coastal infrastructure. Information surrounding the outcome of ongoing efforts to combat the negative impacts of climate change and coastal land loss are incomplete. A 2018 report by the National Academies of Sciences, Engineering, and Medicine found that more needs to be done to gain a better understanding of how environmental changes affect coastal communities and infrastructure, especially Gulf Coast energy infrastructure (National Academies of Sciences, Engineering, and Medicine 2018). BOEM has determined that such information is not essential to a reasoned choice among alternatives because the negative impacts are well understood and any improved understanding of successful mitigation of these impacts would be additive to the analysis, but not essential. Additionally, the incremental impacts of the proposed action would be negligible when compared to overall cumulative activities. BOEM has used the best available scientific information to date and reasonably accepted scientific methodologies to extrapolate from existing information. Therefore, the incomplete or unavailable information, while relevant, would not likely change the impact conclusions reached in this analysis and is not essential to a reasoned choice among alternatives.

4.15 Economic Factors

Economic factors explain and quantify the human behaviors that determine the positive and negative effects that may arise from both OCS oil- and gas-related activities and non-OCS oil- and gas-related activities. The OCS oil- and gas-related activities affect various onshore areas because of the many industries involved and because of the complex supply chains for these industries. Several of these impacts occur in counties and parishes along the Gulf of Mexico region.

4.15.1 Affected Environment

BOEM aggregates 133 counties and parishes from the five Gulf Coast States into 23 economic impact areas (EIAs) based on economic and demographic similarities among counties and parishes (Varnado and Fannin 2018). Much of BOEM's socioeconomic analyses focus on these EIAs since many of the positive and negative effects related to OCS oil and gas leasing in the GOM are concentrated in these EIAs. These EIAs are used as consistent units presenting economic and demographic data. **Figure 4.15-1** shows a map of the EIAs in the GOM region. For more information on EIAs, refer to Chapter 2.5 of the GOM Oil and Gas SID.

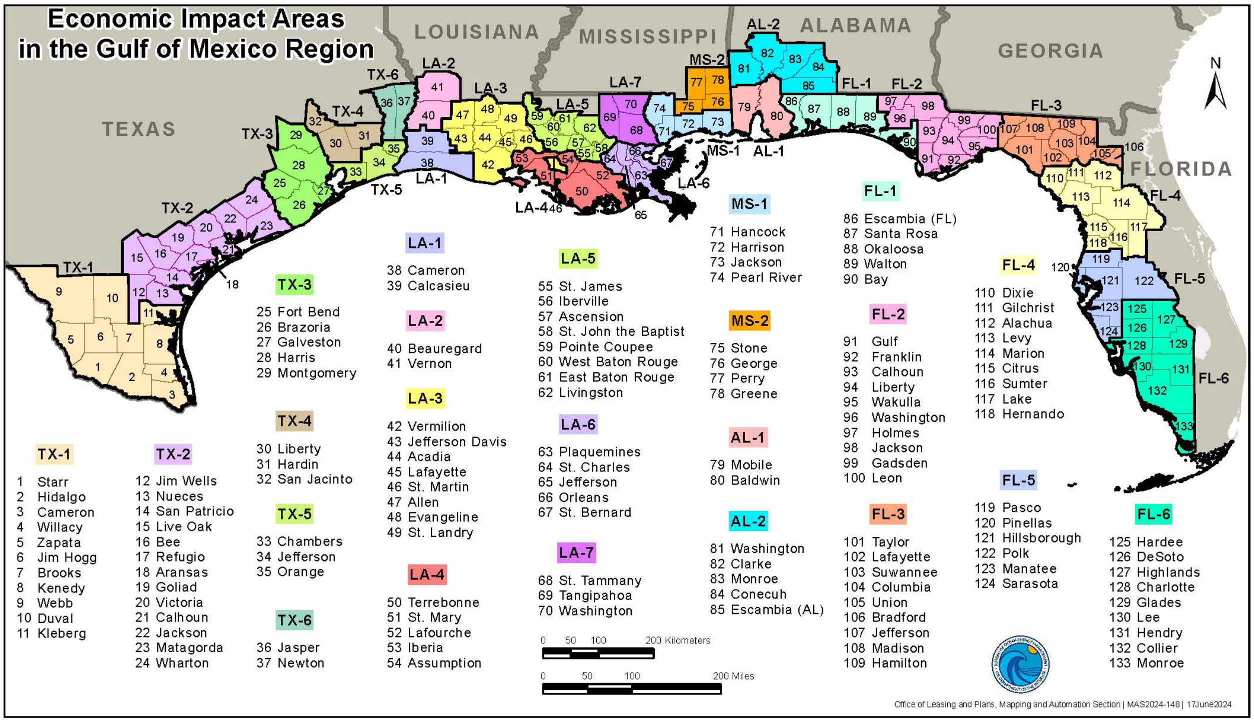

Figure 4.15-1. Economic Impact Areas in the Gulf of Mexico Region.

Economic and Demographic Data

BOEM measures baseline economic conditions in the GOM region by utilizing economic data provided by Woods & Poole Economics, Inc. These data provide baseline and projected economic information for both OCS oil- and gas-related activity and non-OCS oil- and gas-related activity in the GOM region. These data are derived from historical local, regional, and national data, as well as likely changes to economic and demographic conditions. The projections include employment associated with the continuation of current patterns in OCS leasing activity, as well as the continuation of trends in other industries important to the region. BOEM acknowledges that these data are not comprehensive but provide reasonable projections based on future possible projects and actions.

The Woods & Poole Economics, Inc. data include county-level economic and demographic data for prior years, as well as forecasts through 2050. BOEM aggregates these data by EIA for select socioeconomic variables, including population, employment, gross regional product, labor income, median age, sex, and race composition. According to Woods & Poole Economics (2023) (**Table 4.15-1**), the largest EIAs in 2021 (presented in descending order of gross regional product) were TX-3 (which includes Houston and Galveston), FL-5 (which includes Tampa), LA-6 (which includes New Orleans), FL-6 (which includes Fort Myers), LA-5 (which includes Baton Rouge) and TX-1 (which includes Laredo). The smallest EIAs (presented in ascending order of gross regional product) were MS-2, TX-6, LA-2, TX-4, and AL-2. The forecasts from Woods & Poole Economics (2023) for future years are presented in **Table 4.15-2** below.

Table 4.15-1. Economic and Demographic Information for BOEM's Economic Impact Areas in 2021.

EIA	Population[1]	Employment[1]	Gross Regional Product (thousands, 2012 dollars)[1]	Labor Income (thousands, 2012 dollars)[1]	Median Age[2]	Male Percent[2]	White[2]	Black[2]	Hispanic[2]	Native American[2]	Asian[2]
TX-1	1,724,323	823,317	$49,917,336	$30,583,015	32.8	49.1%	6.3%	0.5%	92.3%	0.1%	0.8%
TX-2	746,285	419,836	$37,940,778	$20,548,735	39.3	50.2%	35.3%	4.8%	57.8%	0.3%	1.9%
TX-3	6,979,839	4,326,635	$455,535,021	$286,099,795	36.3	49.4%	34.3%	17.6%	38.8%	0.3%	9.1%
TX-4	182,255	61,244	$3,853,795	$2,148,261	39.7	49.3%	70.7%	8.2%	19.9%	0.4%	0.8%
TX-5	386,893	207,790	$22,181,414	$11,121,831	36.5	50.9%	51.1%	25.2%	20.1%	0.4%	3.2%
TX-6	44,772	17,583	$1,440,481	$592,172	42.6	50.0%	74.4%	17.8%	6.4%	0.7%	0.7%
LA-1	210,194	124,716	$13,658,332	$7,189,478	38.8	48.9%	67.6%	26.1%	4.2%	0.5%	1.6%
LA-2	84,675	39,240	$3,017,499	$1,943,913	34.0	52.3%	75.2%	14.0%	7.5%	1.3%	2.0%
LA-3	580,101	320,619	$21,812,721	$13,993,294	37.4	49.1%	67.4%	27.0%	3.7%	0.5%	1.4%
LA-4	344,762	179,190	$13,309,977	$8,903,374	38.9	49.1%	66.6%	23.4%	5.2%	3.2%	1.6%
LA-5	868,037	535,307	$50,983,268	$29,319,873	38.1	48.4%	55.0%	37.7%	4.6%	0.3%	2.4%
LA-6	931,011	602,941	$54,261,773	$32,848,182	37.5	48.0%	44.7%	40.4%	10.6%	0.4%	3.9%
LA-7	450,771	228,138	$17,327,465	$11,729,036	38.8	48.6%	72.7%	20.3%	5.3%	0.5%	1.3%
MS-1	456,631	238,491	$19,007,927	$11,011,149	40.2	48.9%	69.7%	21.7%	5.7%	0.5%	2.5%
MS-2	68,515	22,161	$1,359,635	$712,278	38.6	51.8%	80.1%	16.7%	2.2%	0.4%	0.5%
AL-1	652,378	364,730	$28,368,713	$16,815,720	40.7	47.9%	66.8%	26.8%	3.6%	0.9%	1.9%
AL-2	105,484	49,265	$3,915,141	$2,040,401	43.0	48.7%	57.3%	37.1%	2.1%	2.9%	0.5%
FL-1	990,396	576,795	$46,252,808	$29,161,022	39.8	50.3%	74.6%	14.2%	7.1%	0.7%	3.3%
FL-2	512,684	293,024	$20,959,035	$13,761,663	41.5	49.8%	61.0%	29.6%	6.3%	0.5%	2.6%
FL-3	232,240	92,592	$6,718,015	$3,609,683	41.7	54.1%	69.9%	21.6%	7.1%	0.5%	0.9%
FL-4	1,636,141	714,201	$52,120,706	$30,323,164	48.6	48.5%	72.8%	11.5%	12.6%	0.3%	2.7%
FL-5	4,645,631	2,708,264	$227,724,737	$137,542,615	46.1	48.6%	63.0%	12.3%	20.8%	0.3%	3.6%
FL-6	1,670,538	901,654	$72,496,301	$42,040,830	46.9	49.5%	65.5%	8.1%	24.3%	0.3%	1.7%

[1] Economic variables.

[2] Demographic variables.

Notes: AL = Alabama; EIA = economic impact area; FL = Florida; LA = Louisiana; MS = Mississippi; TX = Texas.

Source: Woods & Poole Economics (2023).

Table 4.15-2. Economic and Demographic Information for BOEM's Economic Impact Areas in 2050.

EIA	Population[1]	Employment[1]	Gross Regional Product (thousands, 2012 dollars)[1]	Labor Income (thousands, 2012 dollars)[1]	Median Age[2]	Male Percent[2]	White[2]	Black[2]	Hispanic[2]	Native American[2]	Asian[2]
TX-1	2,431,518	1,429,527	$114,970,677	$68,888,213	40.6	48.5%	4.0%	0.5%	94.8%	0.0%	0.7%
TX-2	813,111	559,913	$56,971,311	$33,379,409	41.7	51.0%	25.7%	6.3%	65.2%	0.3%	2.6%
TX-3	10,141,025	6,881,759	$928,216,351	$586,923,965	38.2	48.5%	19.9%	15.0%	48.7%	0.3%	16.1%
TX-4	228,683	88,641	$6,123,921	$4,261,304	42.3	49.0%	59.1%	8.0%	31.1%	0.5%	1.3%
TX-5	420,115	284,104	$38,759,493	$19,978,975	41.3	51.3%	37.2%	22.4%	36.5%	0.4%	3.6%
TX-6	44,712	19,484	$1,614,789	$856,655	45.5	49.9%	61.8%	23.7%	12.7%	0.6%	1.2%
LA-1	228,028	195,666	$21,998,401	$13,355,503	42.0	48.7%	64.1%	27.4%	5.5%	0.6%	2.5%
LA-2	84,936	46,334	$4,429,031	$3,012,134	37.6	52.2%	71.8%	13.9%	10.4%	1.1%	2.7%
LA-3	653,827	438,176	$37,255,119	$23,515,467	42.0	49.3%	63.1%	29.4%	5.3%	0.4%	1.8%
LA-4	341,643	216,333	$19,898,711	$13,353,773	43.3	48.9%	57.6%	25.0%	10.4%	4.3%	2.7%
LA-5	1,031,663	766,717	$81,236,181	$50,367,612	44.0	48.9%	49.7%	40.9%	6.1%	0.2%	3.0%
LA-6	798,673	677,263	$74,067,586	$43,910,840	40.6	48.6%	34.2%	40.5%	18.9%	0.4%	5.9%
LA-7	582,832	375,302	$32,241,391	$22,435,062	42.9	48.2%	65.5%	23.2%	8.6%	0.5%	2.2%
MS-1	501,706	279,783	$24,434,872	$15,390,294	43.2	49.0%	64.2%	24.2%	8.4%	0.4%	2.8%
MS-2	79,090	27,432	$1,891,600	$1,118,919	42.6	52.2%	76.9%	19.4%	2.7%	0.4%	0.7%
AL-1	765,517	496,883	$45,165,824	$26,119,898	43.6	47.7%	63.8%	27.5%	5.2%	0.7%	2.8%
AL-2	99,831	56,172	$5,009,382	$2,735,467	48.1	50.2%	50.0%	42.2%	3.1%	3.7%	1.0%
FL-1	1,267,214	853,444	$84,184,325	$51,861,541	44.2	51.9%	69.8%	16.6%	9.1%	0.5%	4.0%
FL-2	608,240	388,092	$33,524,974	$21,450,204	47.3	51.6%	54.8%	35.6%	6.0%	0.4%	3.2%
FL-3	277,167	115,946	$9,724,275	$5,508,709	45.6	55.8%	66.5%	23.5%	8.4%	0.4%	1.2%
FL-4	2,537,457	1,143,475	$102,608,301	$59,031,858	53.0	50.2%	66.9%	13.5%	15.6%	0.3%	3.7%
FL-5	6,255,010	3,860,649	$403,649,956	$239,969,295	47.2	48.5%	45.0%	14.6%	33.4%	0.2%	6.9%
FL-6	2,567,680	1,350,034	$134,894,646	$77,316,605	50.6	49.7%	49.7%	10.0%	38.3%	0.2%	1.8%

[1] Economic variables.

[2] Demographic variables.

Notes: AL = Alabama; EIA = economic impact area; FL = Florida; LA = Louisiana; MS = Mississippi; TX = Texas.

Source: Woods & Poole Economics (2023).

Offshore Oil and Gas Industry

BOEM utilized data from Data Axle at the State level to describe the oil and gas industry and associated support industry in the GOM region (i.e., Texas, Louisiana, Mississippi, Alabama, and Florida). The data were updated continuously during 2022. These State-level data allow BOEM to address issues inherent in limiting economic impact modeling to narrowly defined geographic areas (e.g., leakages through imports, taxes, profit, and commuting).

The oil and gas extraction subsector is composed of many different company types that are involved in operating and developing oil and gas fields. This array of industries has been working in the GOM region for many decades. **Table 4.15-3** presents employment data for the GOM companies directly involved in oil and gas extraction activities. As of 2021, nearly 6,000 companies are maintaining 169,000 jobs and generating more than $116.5 billion in annual sales. More than 72 percent of the companies employ less than 10 people and generate more than 12 percent of revenues (Data Axle Inc. 2022). It is challenging to separate onshore and OCS oil- and gas-related activities because many companies operate in both spaces. However, the U.S. Energy Information Administration collects oil production data from both areas. In 2021, nearly 25.8 percent of the total oil and 5.5 percent of the total gas production in the Gulf of Mexico came from offshore sources (Energy Information Administration 2023). However, the companies operating in the offshore space may use more capital-intensive technologies and, as a result, may employ fewer people and pay higher wages.

Table 4.15-3. Oil and Gas Extraction-Related Companies Operating in the Gulf of Mexico Region by Employment Category as of 2021.

Employment Category	Number of Companies	Total Employment	Annual Sales ($ million)
<5	2,352	6,428	$4,767
5 to 10	1,931	12,212	$9,343
10 to 50	1,306	23,982	$15,843
50 to 100	164	10,286	$4,751
100 to 500	151	27,429	$16,122
500 to 1,000	20	11,923	$5,857
1,000 to 5,000	12	22,500	$13,296
>5,000	3	54,000	$46,535
Total	5,939	168,760	$116,514

Source: Data Axle Inc. (2022).

Oil and gas support activities are even more critical in the GOM region. Companies are engaged in various contract work such as geological and geophysical exploration, drilling, derrick building, repairing and dismantling of oil and gas fields, building oil and gas well foundations, excavating mud pits, gas well rig building, repairing and dismantling, and well completions and stimulation. **Table 4.15-4** shows oil and gas support activities by employment category in the GOM region. As of 2021, a total of 27,759 companies were engaged in support activities that employ 432,620 thousand people and generate $114.5 billion in revenues. Many small companies employing less than 5 people were much higher in support activities than oil and gas extraction activities; more than 70 percent of the companies employ less than 10 people. Many companies engaged in support activities also work in offshore and onshore spaces. Therefore, the challenge of separating onshore and offshore activities still exists.

Table 4.15-4. Oil and Gas Support-Related Companies in the Gulf of Mexico Region by Employment Category as of 2021.

Employment Category	Number of Companies	Total Employment	Annual Sales ($ million)
<5	12,031	32,197	$6,108
5 to 10	7,544	47,372	$9,856
10 to 50	6,712	124,631	$27,686
50 to 100	866	55,032	$12,285
100 to 500	536	91,770	$23,308
500 to 1K	43	29,015	$8,170
1K to 5K	26	45,103	$25,693
>5K	1	7,500	$1,379
Total	27,759	432,620	$114,484

Source: Data Axle Inc. (2022).

Oil and Gas Production in the Gulf of Mexico

The economic effects of the oil and gas industry are influenced by a variety of factors, including economic conditions, technological advancements, political events, and historical production trends. **Figure 4.15-2** shows long-term oil and gas production indices for the United States as a whole, the five Gulf Coast States, and the Gulf of Mexico OCS (the shades of red represent gas and the shades of green represent oil), which have varied over time. For example, the oil price crash in 2014 caused slowdowns in offshore drilling activities (Beaubouef 2015) and rig construction (Odell 2015). However, offshore investments increased in 2019 after an oil price recovery in 2018, and OCS oil production has increased overall though highly volatile and OCS gas production has been consistently declining since 2001.

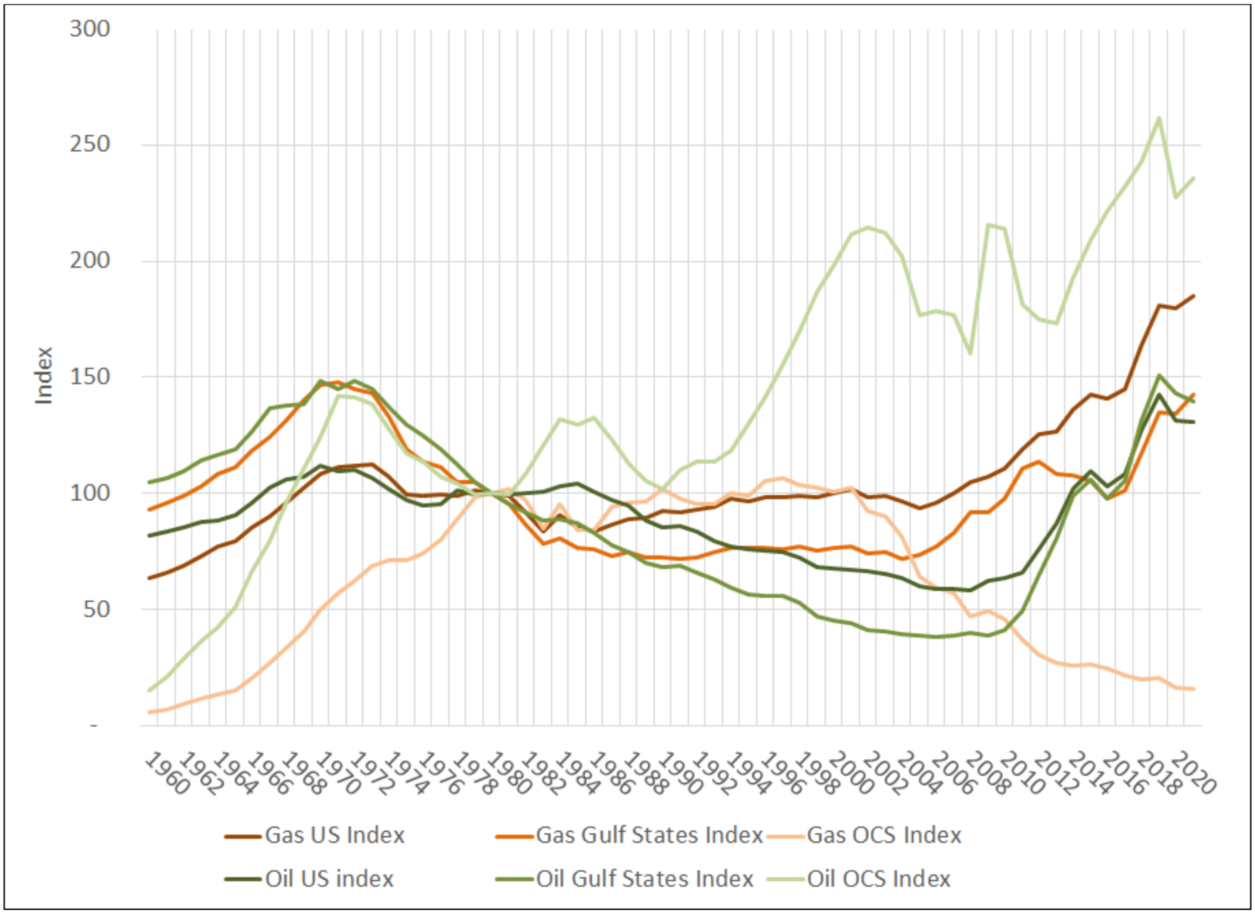

Figure 4.15-2. Oil and Gas Production Indices 1960-2021 (Source: Energy Information Administration [2023]).

From 2010 onward, OCS oil and gas indices diverged greatly, with oil production peaking in 2019 and OCS gas reaching its lowest point in 2021. The increase in deepwater production after 2000, where commercially viable oil is more prevalent than commercially viable gas, has contributed in part to the reduction in gas production on the OCS. The U.S. and Gulf Coast States' gas and oil indices between 2010 and 2021 increased substantially. Overall, Gulf of Mexico OCS oil production grew by 1.1 percent annually from 1960 to 2021. Technological advancements, such as the "shale revolution," contributed to the growth in land-based oil production. Similarly, enhancements in development and production techniques (e.g., spar, tension-leg platform, and subsea completions) for deepwater fields, coupled with the available volume of hydrocarbons and the rate of production, have contributed to the growth of deepwater OCS oil production. Offshore oil and gas production are generally slow to respond to changes in energy prices since offshore developments take years to be designed, approved, and developed. Once a project is producing, it is often most profitable to maintain production as long as the revenues received are above the marginal costs of production. BOEM utilizes production data submitted to BSEE along with knowledge of oil and gas reserves and resources to forecast future production. In 2023, GOM annual crude oil production was about 681.84 million barrels (MMbbl), averaging 1.87 MMbbl of oil per day, while annual natural gas production in 2022 was about 696.8 billion cubic feet, averaging 1.9 billion cubic feet per day (Energy Information Administration 2024a). Natural gas production is expected to remain relatively flat, while crude oil production is forecasted to increase to 1.94 MMbbl/day in 2024 (Energy Information Administration 2024b) and continue this upward trend into 2025. However, the industry faces challenges from declining economically recoverable reserves, increasing competition from renewable energy sources, and changing economic and political conditions that introduce some uncertainty into future forecasts of oil and gas production.

BOEM relied on several other data sources for information concerning economic factors in the GOM region when conducting this analysis. Kaiser and Narra (2018b) provide a robust overview of GOM oil and gas infrastructure inventories and trends, as well as operating cost data analysis and a decommissioning forecast for shallow and deepwater regions. Quest Offshore Resources Inc. (2011) provides an overview of the spending impacts of the offshore oil and gas industry in the Gulf of Mexico. This report estimates that $26.9 billion in capital and operating expenditures supported $29.1 billion in U.S. gross domestic product in 2009. Kaiser et al. (2013) provide background information on the drilling and rig construction markets, Kaplan et al. (2011a) provides background information on the oil services contract industry, and Priest and Lajaunie (2014) and McGuire et al. (2014) provide background information on the shipbuilding and fabrication industries. These data are used to assess the importance of the offshore oil and gas industry on onshore industries in the GOM region.

Office of Natural Resources Revenue Data

In addition to industry spending, profits, and employment, government revenues from offshore oil- and gas-related activities are generated through bonus bids, rental payments, and royalty payments. The U.S. Department of the Interior's Office of Natural Resources Revenue collects these revenues and provides production, revenue, and disbursement data, including but not limited to Federal OCS oil- and gas-related activities. BOEM's "Fair Market Value" webpage describes the rental rates, royalty rates, and other terms associated with Gulf of Mexico leases (BOEM 2024b). BOEM's "Royalty Relief Information" webpage provides more information regarding BOEM's royalty relief programs (BOEM 2024c).

Table 4.15-5 presents annual data regarding sales volumes, sales values, and government revenues received from Federal OCS oil- and gas-related activities in the Gulf of Mexico (ONRR 2023; 2024).

Table 4.15-5. Sales Volumes, Sales Values, and Revenues from OCS Oil- and Gas-Related Activities in the Gulf of Mexico.

Product Type	2017	2018	2019	2020	2021	2022	2023
Panel A: Sales Volumes – Gas (royalty) (Mcf)	688,438,658	644,625,654	705,093,904	602,517,338	507,807,516	541,334,267	538,101,059
Panel A: Sales Volumes – Gas (non-royalty) (Mcf)	263,893,238	127,453,290	126,227,458	108,338,224	86,338,627	69,754,982	52,944,159
Panel A: Sales Volumes – NGL (royalty) (gal)	1,666,865,764	1,761,166,271	2,050,562,634	1,876,979,720	1,770,070,074	1,952,341,979	2,056,358,124
Panel A: Sales Volumes – NGL non-(royalty) (gal)	627,342,773	478,323,341	460,838,472	435,138,381	397,521,931	307,527,896	238,003,076
Panel A: Sales Volumes – Oil (royalty) (bbl)	476,546,163	479,105,687	553,422,382	482,141,373	476,491,886	515,042,031	568,574,037
Panel A: Sales Volumes – Oil (non-royalty) (bbl)	142,064,035	130,248,339	133,704,765	164,876,551	129,858,532	110,571,896	101,862,261
Panel B: Sales Values – Gas ($)	$2,134,276,049	$1,909,712,356	$2,103,825,424	$1,236,458,002	$1,669,328,854	$3,652,830,297	$1,955,350,770
Panel B: Sales Values – NGL ($)	$916,870,931	$1,265,581,002	$989,162,443	$598,511,026	$1,046,769,170	$1,804,121,388	$1,136,575,121
Panel B: Sales Values – Oil ($)	$22,740,606,708	$31,597,443,221	$34,560,758,308	$21,356,511,325	$28,606,047,952	$47,884,009,371	$44,553,457,472
Panel B: Sales Values – Other Products ($)	-	$4,242	-	-	$67,530	$24,505	$5,556
Panel B: Sales Values – Total Sales Value ($)	$25,791,753,687	$34,772,740,821	$37,653,748,193	$23,191,482,373	$31,322,215,527	$53,340,987,583	$47,645,388,919
Panel C: Revenues – Gas Royalties ($)	$258,912,390	$230,038,882	$254,659,899	$138,809,790	$204,937,263	$482,116,243	$237,328,319
Panel C: Revenues – NGL Royalties ($)	$91,516,376	$134,601,421	$93,388,897	$51,507,584	$105,715,194	$194,769,362	$114,405,481
Panel C: Revenues – Oil Royalties ($)	$2,892,693,599	$4,071,169,795	$4,500,169,908	$2,742,395,156	$3,713,071,790	$6,353,964,333	$5,984,607,331
Panel C: Revenues – Oil & Gas[1] Royalties ($)	-	-	-	($1,126,523)	($3,385,060)	-	-
Panel C: Revenues – Other Products[2] Royalties ($)	-	$707	-	-	$11,251	$4,084	$926
Panel C: Revenues – Rents ($)	$111,127,193	$101,998,058	$102,682,557	$96,719,870	$85,445,733	$78,916,135	$115,710,978
Panel C: Revenues – Bonus ($)	$281,256,697	$225,964,628	$407,261,497	$241,234,980	$111,559,312	-	$434,446,209
Panel C: Revenues – Other Revenues ($)	$45,301,359	$67,349,182	$19,123,597	($19,946,211)	$49,826,743	$132,783,718	$7,213,226
Panel C: Revenues – Total Revenues	$3,680,807,614	$4,831,122,673	$5,377,286,354	$3,249,594,648	$4,267,182,225	$7,242,553,874	$6,893,712,470

Notes: NGL = natural gas liquids; bbl = barrel; gal = gallon; Mcf = thousand cubic feet.

[1] Other products for sales values and revenues include sodium and sulfur.

[2] In 2020 and 2021 there are negative royalties for oil and gas; this is due to temporary royalty relief that was granted during that time period due to the pandemic.

Source: ONRR (2024).

4.15.2 Environmental Consequences

Economic factors in the GOM are affected by existing environmental conditions, natural processes and phenomena, and human-induced factors. There are also several OCS oil- and gas-related activities and non-OCS oil- and gas-related activities that have the potential to impact economic factors (**Table 4.15-6**). BOEM conducted an initial screening of IPFs in the GOM Oil and Gas SID and determined that socioeconomic changes and drivers, unintended releases into the environment, response activities, strikes and collisions, and climate change could potentially impact economic factors. Many of these activities can have direct, indirect, cumulative, or unknown benefits or adverse impacts to economic factors and may be felt unevenly and by different groups or sectors across the Gulf of Mexico region. These IPFs and their potential to affect economic factors are discussed in greater detail in Chapter 4.4.7 of the GOM Oil and Gas SID. Supporting rationale for IPFs that were not analyzed in detail in this Programmatic EIS can also be found in Chapter 4.4.7 of the GOM Oil and Gas SID. New information released since the development of the GOM Oil and Gas SID and relevant to the analysis is included in the applicable chapters below.

Table 4.15-6. Impact-Producing Factors with the Potential to Impact Economic Factors.

OCS Oil- and Gas-Related Routine Activities	OCS Oil- and Gas-Related Accidental Events	Non-OCS Oil- and Gas-Related Activities
Socioeconomic Changes and Drivers	Unintended Releases into the Environment	Socioeconomic Changes and Drivers
-	Response Activities	Climate Change
-	Strikes and Collisions	-

There are several existing regulatory programs and requirements to reduce the potential effects from these IPFs in the GOM while taking into account economic factors and are enforced by BOEM, BSEE, and other agencies. For example, leases are not issued until BOEM has completed an extensive bid evaluation process to ensure that the Federal Government receives fair market value for the lease in accordance with Section 18 of the OCSLA (43 U.S.C. § 1344). The *Gulf of Mexico OCS Regulatory Framework* technical report (BOEM 2020a) overviews the complex interconnected regulatory regime that exists around GOM oil- and gas-related activities. Lessees are required to perform OCS oil- and gas-related activities in accordance with regulatory requirements; therefore, the analysis factors in the mitigating effects of all applicable regulatory requirements as part of the proposed action when making impact determinations.

4.15.2.1 OCS Oil- and Gas-Related Impact-Producing Factors from Routine Activities

***Socioeconomic Changes and Drivers*:** Routine activities arising from OCS oil- and gas-related activities could have various economic effects. Extraction of oil, natural gas liquids, and natural gas generate expenditures on various goods and services, as well as generate jobs. Routine activities could also generate corporate profits and government revenues, as well as have effects on the overall energy market. In FY 2022, OCS oil- and gas-related activities sustained approximately 246,000 jobs and generated an estimated $30 billion in domestic value-added to the national GDP (BOEM 2024a). BOEM estimates that approximately 69 percent of jobs remained in the states adjacent to the GOM (i.e., Texas, Louisiana, Mississippi, Alabama, and Florida).

***Expenditure Impacts*:** The OCS oil- and gas-related activities could have economic effects on a variety of businesses along the OCS industry's supply chain. For example, OCS oil- and gas-related activities could directly affect firms that drill wells, manufacture equipment, construct pipelines, and service OCS oil- and gas-related activities. The OCS oil- and gas-related activities could also affect the suppliers to those firms, as well as firms that depend on consumer spending of oil and gas industry workers. BOEM uses economic and financial models to estimate the output, value added, income, and employment associated with OCS oil- and gas-related activity. The model then allocates these expenditures to geographic areas and applies a series of economic multipliers (IMPLAN[12]) to estimate the economic impacts associated with these expenditures. Historically, most of these effects are geographically distributed to the GOM region, particularly in coastal Texas and Louisiana.

Government Revenue Impacts: The OCS oil- and gas-related activities would generate government revenues through bonus bids, rental payments, royalty payments, taxes, and Gulf of Mexico Energy Security Act (GOMESA) distributions (Pub. L. 109-432). The GOMESA provides for the sharing of OCS revenues with States, counties/parishes, and the Land and Water Conservation Fund, supporting local and State coastal conservation, restoration, and hurricane protection project and goals. The GOMESA distributions, however, are not directly tied to individual lease sales. Instead, annual distributions are based on specified percentages of the aggregate qualified OCS revenue within that year. Determining the proportion of these annual revenues that can be linked to a specific, individual lease sale from year to year is challenging and would be speculative to forecast for a single proposed OCS oil and gas lease sale. However, it is worth noting that the GOMESA revenue sharing cap (which is $500 million annually through 2055 for State/local governments and the Land and Water Conservation Fund combined) is likely to be reached in future years due to revenues from existing leases and, therefore, such revenue sharing is not projected to increase due to new leases resulting from a single proposed OCS oil and gas lease sale.

Effects resulting from the generation of these revenues depend on where and how the revenues are used. Historically, most revenues beyond the revenue sharing provisions have accrued directly to the Federal Treasury. This implies that the Federal revenue effects of OCS oil- and gas-related activities could be widespread, and thus not overly concentrated in BOEM's economic impact areas. The OCS oil- and gas-related activities can also induce government revenues arising from taxes on economic activities (such as taxes on profits and dividends). A detailed description of revenue sharing is presented in Chapter 4.4.7.2.2 of the GOM Oil and Gas SID.

Corporate Profit Impacts: The OCS oil- and gas-related activities could also generate profits to firms along the OCS supply chain. Corporate profits can be distributed to stockholders as dividends

[12] IMPLAN is an economic modeling software that helps analyze the impacts of various projects or events on regional economies. With its user-friendly interface and comprehensive data, IMPLAN allows users to simulate and predict the economic effects of changes in industries, employment, and income. IMPLAN enables policymakers, researchers, and businesses to make informed decisions and understand the complex dynamics of regional economies by providing detailed information on input-output relationships.

or retained by firms for future spending on goods and services. Higher profits can also increase stock prices, which could increase the wealth of stockholders. Since stocks of most energy firms can be held by people from anywhere in the world, the wealth and dividend impacts could be fairly widespread and, thus, not overly concentrated in BOEM's economic impact areas.

Overall Energy Market Impacts: The oil, natural gas, and natural gas liquids produced due to OCS oil- and gas-related activities could meet the demands of end users of those products. Increased energy supply could put downward pressure on energy prices, although the small scale of a proposed lease sale(s) relative to the overall energy market would make these price effects minimal. The OCS oil- and gas-related activities can also contribute to U.S. policy goals of energy independence and security. **Table 4.15-7** shows the total annual economic impacts (e.g., industry expenditure, government revenue, and profit impacts) of a single lease sale for each of the high, mid, and low scenarios.

BOEM employed the Life Cycle Impacts Model (LCIM[13]) to estimate the number of jobs, labor income, and value added (Price et al. 2020). Years with zero activity were not included in the averages because including them would make the averages appear too low. In the low scenario, the proposed action could support up to 1,087 jobs, $77 million in labor income, and $130 million in value-added benefits throughout the U.S., mainly in the GOM region (i.e., the Texas and Louisiana coastal areas). In the high scenario, the action could support up to 18,941 jobs, $1.4 billion in labor income, and $2.2 billion in value-added. The mid scenario could support up to 7,407 jobs, $522 million in labor income, and $863 million in value added, with a similar geographic distribution of impacts as the low scenario.

Table 4.15-7. Annual Averaged Economic Impact Estimates of Gulf of Mexico Single OCS Oil and Gas Lease Sale: High, Mid, and Low Scenarios.

Area	Scenario Case (high, mid, or low)	Employment[1]	Labor Income ($ million)	Value Added ($ million)
Texas EIAs	High	4,427	312	623
Texas Total	High	7,309	522	924
Louisiana EIAs	High	2,979	192	323
Louisiana Total	High	3,646	239	364
Mississippi EIAs	High	301	20	20
Mississippi Total	High	1,247	88	68
Alabama EIAs	High	302	18	26
Alabama Total	High	909	61	75
Florida EIAs	High	529	33	62
Florida Total	High	729	48	85
GOM EIA Total	High	8,539	575	1,054
Gulf of Mexico Total	High	13,840	959	1,516
Rest of U.S.	High	5,101	391	704
U.S. Total	High	18,941	1,350	2,220

[13] The Cumulative Impact Model (CIM) and Life Cycle Impacts Model (LCIM) are models developed by BOEM to assess the economic and fiscal impacts of OCS oil- and gas-related activities.

Area	Scenario Case (high, mid, or low)	Employment[1]	Labor Income ($ million)	Value Added ($ million)
Texas EIAs	Mid	1,844	130	256
Texas Total	Mid	2,750	194	349
Louisiana EIAs	Mid	1,269	82	137
Louisiana Total	Mid	1,526	100	153
Mississippi EIAs	Mid	127	9	9
Mississippi Total	Mid	501	35	28
Alabama EIAs	Mid	137	8	12
Alabama Total	Mid	378	25	31
Florida EIAs	Mid	228	14	26
Florida Total	Mid	304	20	35
Gulf of Mexico EIA Total	Mid	3,605	242	440
Gulf of Mexico Total	Mid	5,459	375	596
Rest of U.S.	Mid	1,948	147	267
U.S. Total	Mid	7,407	522	863
Texas EIAs	Low	352	25	49
Texas Total	Low	420	30	56
Louisiana EIAs	Low	236	15	26
Louisiana Total	Low	272	18	28
Mississippi EIAs	Low	23	2	2
Mississippi Total	Low	80	6	4
Alabama EIAs	Low	31	2	3
Alabama Total	Low	65	4	5
Florida EIAs	Low	47	3	5
Florida Total	Low	56	4	6
Gulf of Mexico EIA Total	Low	689	47	84
Gulf of Mexico Total	Low	893	62	100
Rest of U.S.	Low	194	15	30
U.S. Total	Low	1,087	77	130

EIA = economic impact area.

[1] Employment represents new activities for this OCS oil and gas lease sale, which may include individuals that are moving from previous, completed oil- and gas-related employment (i.e., a continuation of oil and gas employment).

Source: BOEM internal modeling estimates.

4.15.2.2 OCS Oil- and Gas-Related Impact-Producing Factors from Accidental Events

Unintended Releases into the Environment: Petroleum spills from OCS oil- and gas-related activities include crude oil, condensate, and refined products such as diesel, hydraulic oil, lube oil, and mineral oil. Accidental events, such as oil and chemical spills, can lead to corresponding issues with local economies. The most direct impacts would likely be experienced in industries that depend on resources that are damaged or rendered unusable for a period of time. For example, beach recreation, recreational fishing, and commercial fishing would be vulnerable if beach or fish resources were damaged due to an accidental event. In addition, an oil spill could also impact transportation routes and the operations of port facilities. Oil spills can arise from accidents with respect to OCS oil- and gas-related vessels, pipelines, drilling operations, or production operations. The exact effects of an oil spill on economic factors would depend on the locations of oil spills, their frequency, duration, and geographic extent (refer to Chapter 4.4.7.2.3 of the GOM Oil and Gas SID).

Response Activities: Potential effects related to spill response may be negative or positive for the local economy. The influx of spill-response workers could contribute to filling short-term rental vacancies at hotels, apartments, and other properties that could provide housing, which could be a positive effect on land use and, by extension, on the local economies. Restaurants and hotels in the spill-response area could receive an influx of demand from cleanup workers that could offset losses otherwise expected from tourism declines resulting from a spill. However, the resources and funds required for effective response activities may divert attention and resources from other critical environmental and economic issues. Additionally, response activities may close off a location near a spill, which could preclude other activities (e.g., recreation and fishing) and which negatively impacts the local economy. Refer to Chapters 4.4.1 and 4.4.5 of the GOM Oil and Gas SID for additional detail. The expected economic impacts of response activities for an oil spill depend on the timing, size, and location of the spill, and the use of technologies to reduce the probability of an accidental event occurring.

Strikes and Collisions: Vessel collisions with each other or coastal structures could affect the economy. If a vessel were to collide with a bridge, pier, or other structure, it could disrupt the transportation of goods, services, and people to and from work and schools. The severity of the effects that could ripple through the economy would be dependent on the location of the vessel collision, the size of the vessels involved, and whether the collision involves a bridge, pier, or other structure. However, repairing and replacing damaged vessels and structures can create jobs and generate revenue for the economy. For more information, refer to Chapters 4.14 and 4.4.1 of the GOM Oil and Gas SID.

4.15.2.3 Alternatives Analysis

Alternative A – No Action (Cancellation of a Single Proposed OCS Oil and Gas Lease Sale)

Under Alternative A, the proposed OCS oil and gas lease sale would not take place and no new routine activities or accidental events associated with the proposed action would occur. However, indirect impacts from socioeconomic changes and drivers and ongoing OCS oil- and gas-related activities and non-OCS oil and gas sectors would still contribute to the existing environmental baseline. Ongoing activities stemming from previous OCS oil and gas lease sales may potentially have direct impacts on economic factors through socioeconomic changes and drivers, unintended releases into the environment, response activities, as well as strikes and collisions. The potential impacts from these IPFs are summarized in **Chapter 4.15.2.2** with greater detail in Chapter 4.4.3 of the GOM Oil and Gas SID.

The GOM region is currently experiencing continuous OCS oil- and gas-related operations resulting from a long history of regularly occurring OCS oil and gas lease sales (typically annually with a few exceptions). As of May 2024, there are 2,359 active leases in the region that are currently contributing to regional economics and employment and will continue for years to come.[14] Production revenue from existing leases is expected to continue contributing to the GOMESA revenue sharing and meeting the program's annual $500 million cap, even without the revenue that would have resulted from the cancelled lease sale. However, cancelling an OCS oil and gas lease sale extends beyond leaseholders, exerting an impact on the support economy and creating uncertainties regarding employment. There could be short-term adverse impacts if operators scale back exploratory activities that were contingent on the availability of adjacent or nearby lease areas, in turn impacting the economics and employment of oil and gas support-related companies such as those summarized in **Table 4.15-4**. However, short-term adverse economic impacts from cancelling a single proposed OCS oil and gas lease sale would likely be **negligible** because production from existing leases (which is at a record high level [Energy Information Administration 2024b]) would continue and would be expected to largely sustain current or very similar economic conditions. Cancellation of a single proposed OCS oil and gas lease sale could, however, have more notable impacts on future production as production from newly issued deepwater leases would typically occur approximately 10 years or more after lease issuance.

While short-term impacts may be minimal, over time the impacts could start to increase. For example, not holding an OCS oil and gas lease sale would prevent the receipt of OCS revenues from bonus bids, royalties, and rental payments associated with the forgone leases. The government would immediately lose (or potentially forego until a future lease sale) revenues from bonus bids, and rental receipts could temporarily decline as existing leases expire or transition into production status, where they no longer generate rental income (leases in production would generate royalties). The royalties, which constitute the largest share of revenues generated from OCS production, would only experience a slight decrease in the short-term given the length of time before production begins on new leases.

In the context of the GOM's long-term economic prospects, the magnitude of adverse effects from the absence of new leases over a 4-year period would depend on how industry responds (**Chapter 2.2.1**). These impacts may gradually unfold over a period of 15 years or more, particularly in deep water oil and gas production. For example, if undeveloped discoveries are perceived as less financially rewarding by operators, a perceived or actual lack of new leasing and exploration opportunities could potentially constrain satellite and tie-back options for major investment production hubs. Additionally, smaller deepwater discoveries could face financial challenges, or even bankruptcy, without access for tiebacks to a central production facility. Operators may re-evaluate capital investments in exploratory efforts and exercise greater scrutiny when making final investment decisions for new developments, in some cases possibly choosing to invest and develop in other countries rather than in Gulf of Mexico OCS waters. This is particularly relevant in geologic basins where future production from new leases may no longer be feasible. Large deepwater projects often rely on subsequent discoveries to maintain capacity as initial field volumes decline, as evidenced by the prevalence of new leasing and investments around existing discoveries and infrastructure.

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[14] Updated leasing statistics can be found on BOEM's website at https://www.boem.gov/gom-interactive-lease-statistics-dashboard.

In addition to the direct contribution to the energy economy, OCS oil- and gas-related activities also support economic sectors like marine construction, marine transportation, and ship building. In the short term, the continuation of OCS oil- and gas-related activities through existing capacity and leases, without additional leasing activity from a single proposed OCS oil and gas lease sale, would likely have a negligible effect on these economic sectors. In the longer term, as operators make future plans, these economies could experience more notable effects, particularly if operators decide to scale back operations that rely on these sectors. Other economic sectors such as tourism, recreation, and fisheries would also be impacted by any notable changes in OCS oil- and gas-related activities. Fishing industries utilize offshore structures as fish-attracting devices to enhance their catch. The extent that offshore activities install or decommission structures would have corresponding effects to commercial and recreational fisheries. Oil and gas development may affect demand for recreation and tourism opportunities. Refer to **Chapters 4.10, 4.11, and 4.12** for a complete analysis of the impacts of cancellation of a single proposed OCS oil and gas lease sale on these industries.

Precisely predicting the impact on revenue and employment due to the absence of new leases from the cancelled OCS oil and gas lease sale is challenging, given the lack of historical data of a similar gap in sales and predictive models. Market demand for oil and gas, coupled with fluctuating prices further complicates this issue. Cancelling a single proposed OCS oil and gas lease sale, resulting in a multi-year gap with no new oil and gas leases issued, creates two areas of uncertainty. First, predicting how operators will respond and the indirect economic outcomes from those decisions becomes more challenging. Second, if operators defer or cancel investments in their discoveries because of greater economic uncertainty, then reasonably foreseeable OCS oil- and gas-related activities become more uncertain and baseline impacts (beneficial and/or adverse) may not be realized. The nature of the socioeconomic impacts of Alternative A would also depend on the extent to which other business opportunities would arise, for example, in the renewable energy industry. Considering these factors, the longer-term adverse impacts would likely be **minor adverse** given the number of existing active oil and gas leases either currently producing or in their primary term and varying stages of exploration and development. However, if the potential constraints and shifts in development strategies discussed above were to occur, impacts could be up to **moderate adverse**.

Comparison of Impacts under Alternatives B, C, and D

A regionwide OCS oil and gas lease sale under Alternatives B-D, and the resulting OCS oil- and gas-related development on any subsequent leases, would result in socioeconomic changes and drivers, unintended releases into the environment, response activities, and strikes and collisions that could potentially impact economic factors.

Alternative B represents the largest geographic area under consideration for a regionwide OCS oil and gas lease sale. Alternatives C and D represent geographical constraints on available acreage for leasing, which could change the spatial distribution of the scenario activities, but not their overall activity levels. Therefore, this alternatives analysis is focused on the potential environmental impacts of a regionwide OCS oil and gas lease sale (Alternative B) and then considers if these potential impacts could be reduced by the geographic constraint under each alternative considered

(Alternatives C and D). **Table 4.15-8** shows the impact determinations for each IPF that affects economic factors for each alternative analyzed.

Table 4.15-8. Impact Determinations for Routine and Accidental Impacts to Economic Factors for Alternatives A-D.

Impact-Producing Factor	BOEM's Protective Measure[1]	Alternative A	Alternative B	Alternative C	Alternative D
Socioeconomic Changes and Drivers	N/A	**Negligible** (short-term) and **Minor** to **Moderate** (long-term) **Adverse**	**Minor** to **Moderate Beneficial**	**Minor** to **Moderate Beneficial**	**Minor** to **Moderate Beneficial**
Unintended Releases into the Environment	N/A	N/A	**Minor** to **Moderate Adverse**	**Minor** to **Moderate Adverse**	**Minor** to **Moderate Adverse**
Response Activities	N/A	N/A	**Negligible** to **Minor Adverse**	**Negligible** to **Minor Adverse**	**Negligible** to **Minor Adverse**
Strikes and Collisions	N/A	N/A	**Negligible** to **Minor Adverse**	**Negligible** to **Minor Adverse**	**Negligible** to **Minor Adverse**

[1] No programmatic protective measures for application at the OCS oil and gas lease sale stage are being contemplated in this Programmatic EIS.

Alternative B – Regionwide OCS Lease Sale

A proposed action could negatively affect various resources, as described in the other chapters of this Programmatic EIS. The corresponding adverse economic impacts are also discussed in their respective chapters. For example, routine OCS oil- and gas-related activities could cause adverse impacts to recreational fishing, commercial fisheries, recreational resources, land use and coastal infrastructure, and social factors. The following analysis focuses primarily on economics and employment for the energy sector within the GOM region and EIAs.

Socioeconomic Changes and Drivers: The GOM region contributes approximately 15 percent to total U.S. oil production. The activities mentioned above exert considerable influence on the GOM economy, affecting it in terms of cumulative effects and individual OCS oil and gas lease sales (**Chapters 3.3 and 3.5**). Alternative B considers a regionwide lease sale area. Within this geographic area, socioeconomic changes and drivers from routine activities arising from OCS oil- and gas-related activities could have various economic effects. Extraction of oil, natural gas liquids, and natural gas generate expenditures on various goods and services, as well as generate and sustain jobs. Routine activities can generate employment, labor income, corporate profits and government revenues through bonus bids, rental payments, royalty payments, and GOMESA distributions, while also impacting the overall energy market as discussed in **Chapter 4.15.2.2** above. The oil, natural gas, and natural gas liquids produced by routine OCS oil- and gas-related activities from the proposed action could help meet the demands of end users of those products. Increased energy supply could put downward pressure on energy prices, although the relatively small scale of a single proposed OCS oil and gas lease sale relative to the overall energy market in the GOM (**Chapter 3.3**) would make these price effects minimal. For example, if actual activities resulting from the proposed action resemble the low-case scenario presented in **Chapter 3.3**, beneficial impacts would likely be **minor beneficial**, mostly sustaining existing economic conditions or resulting in a small but measurable economic improvement. If actual activities resulting from the proposed action resemble the mid- to high-case scenario presented in **Chapter 3.3**, however, beneficial impacts could be up to **moderate beneficial**, resulting in a notable and measurable economic improvement.

In terms of employment, a single OCS oil and gas lease would help sustain approximately 13,840 jobs Gulfwide and generate $575 million in labor income and $1,054 million in value added in the high scenario. In the mid scenario, it is expected to sustain roughly 5,459 jobs, $375 million in labor income, and $596 million in value added. In the low scenario, it is expected to sustain about 893 jobs, $62 million in labor income, and $100 million in value added. Considering all of these factors, the impacts of socioeconomic changes and drivers from the proposed action under Alternative B would range from **minor** to **moderate beneficial,** as it represents the continuation of ongoing oil and gas activities both in the short- and long-term and the sustainment or measurable improvement to GOM energy sector economics and employment.

Unintended Releases into the Environment: Impacts from unintended releases into the environment could have a wide range of impacts from relatively little impact related to small offshore spills up to affecting beach recreation, recreational fishing, commercial fishing, tourism, transportation routes, port facility operations, and oil and gas development for large coastal spills. However, it is unlikely that a single oil spill would shut down an entire industry, beach, waterway, or port facility based on the estimated spill rates in **Chapter 3.5**. **Table 3.5-2** shows that spills <500 bbl occur at a higher rate than those ≥500 bbl. Therefore, the expected impact of any spill would be small to correspond to the more likely scenario of a small spill. The other economic issues potentially resulting from an accidental event would be determined by actions or events that occur along with an oil spill. For example, a large oil spill could lead to decreased levels of oil and gas industry operations. This issue would be greatest felt in coastal Louisiana and Texas where OCS oil- and gas-related activity and employment is most concentrated. The direct effects of an oil spill on a particular industry could also ripple through that industry's supply chain; consumer spending by employees of these firms could also have effects to the broader economy. Because spills are more likely to be small (**Table 3.5-2**), their impacts would be more localized and short-term. However, the possibility of a larger spill remains, which could have more widespread or notable impacts. Therefore, the potential impacts from unintended releases would range from **minor** to **moderate adverse**.

Response Activities: Impacts from response activities would affect negatively or positively for the local economy. The influx of spill-response workers could contribute to filling short-term rental vacancies at hotels, apartments, and other properties that could provide housing, which could be a positive effect on land use and, by extension, on the local economies. Restaurants and hotels in the spill-response area could receive an influx of demand from cleanup workers that could offset losses otherwise expected from tourism declines resulting from a spill. Refer to **Chapters 4.14 and 4.12** for additional detail. Conversely, spill-response activities may strain local communities, resulting in the need for costly repairs or upgrades in community infrastructure. Spill response can generate large quantities of waste, which can strain existing waste disposal capacity, and additional use of waterways or roadways used for the vehicles servicing spill response may result in localized increased wear and tear. The severity of spill-response effects on the local economy would depend on the location and duration of the spill and cleanup efforts, as well as whether the event is a small spill or a larger spill. The likelihood of large spills is low and most spills are expected to be short term and localized, with minimal response activities needed to return to pre-spill conditions (**Chapter 4.2**). Therefore, economic impacts from response activities would likely range from **negligible** to **minor adverse**.

Strikes and Collisions: Strikes and collisions could negatively affect the local economy. For example, if a vessel were to collide with a bridge, pier, or other structure, it could disrupt the transportation of goods, services, and people to and from work and schools. The collision could also result in an oil spill, which could negatively affect the economy. The severity of the effects that could ripple through the economy would be dependent on the location of the vessel collision, the size of the vessels involved, and whether the collision involves a bridge, pier, or other structure. Coastal vessel collisions could disrupt the flow of vessels coming from and returning to port. For example, any impediment to fishing vessels leaving or returning to port could reduce the fish sold at market, affecting the fisher's profitability and the seafood supply chain. The recreational fishing industry could also see negative effects if boat launches are closed or charters and rentals are unable to leave from a particular location. However, since strikes and collisions arising from a proposed action would likely be infrequent, localized, and in OCS waters away from shore, the impacts to economic factors would likely be **negligible** to **minor adverse**.

Routine activities can generate employment, labor income, corporate profits and government revenues through bonus bids, rental payments, royalty payments, and GOMESA distributions, while also impacting the overall energy market as discussed in **Chapter 4.15.2.2** above. Based on the description of the IPFs above and the scenario projections for a single proposed OCS oil and gas lease sale provided in **Chapter 3**, the impacts from IPFs associated with Alternative B on economic factors would range from **moderate adverse** to **moderate beneficial** for specific IPFs as discussed above. The generally discreet nature or effects of the accidental events are somewhat outweighed by those of routine activities resulting in **minor** to **moderate beneficial** overall impacts when considered all together. The overall economic impacts would range from **minor** to **moderate beneficial** depending on the actual levels of resulting production, revenues, associated exploration and development activities, and accidental events that occur (**Chapter 3.3**). For example, in the low-case scenario, a single OCS oil and gas lease sale could support up to 893 jobs, $62 million in labor income, and $100 million in value added. In the high-case scenario, a proposed action could support up to 13,840 jobs, $575 million in labor income, and $1,045 million in value-added annually within the EIAs. The geographic distribution of these impacts would be similar across the low-, mid-, and high-case scenarios, with most impacts occurring in the GOM region (**Table 4.15-7**). While the economic and employment impacts from a single OCS oil and gas lease sale represent a relatively small percentage of the overall economies of the 23 EIAs, the magnitude of even a small percentage change in OCS oil- and gas-related activity could have notable beneficial impacts within EIAs that depend heavily on the OCS oil and gas industry, like those along the Louisiana and Texas coasts.

Alternative C – Inflation Reduction Act Targeted OCS Lease Sale Area

Alternative C involves leasing a subset of the area considered in Alternative B by making blocks that would normally be subject to the Topographic Features, Live Bottom (Pinnacle Trend), and/or Blocks South of Baldwin County, Alabama, Stipulations; Wind Energy Areas; and Rice's whale core distribution area unavailable for lease. Therefore, the analysis for those IPFs (described above) covers the potential impacts of Alternative C. From a regional perspective, Alternative C still leaves substantial areas available for leasing across all water depths. Therefore, due to the restrictions imposed by the lease area, Alternative C would provide proportionately less area for activity than Alternative B, resulting in economic impacts that are either similar, or only slightly less than those of Alternative B. Most operators would adapt and relocate to other available lease areas, resulting in a minimal reduction in overall production when compared to Alternative B. However, it is worth noting that some operators specializing in specific depths may experience a disproportionate effect. The revenue, corporate profit, market, and adverse impacts would also be proportionately lower. The nature of potential accidental events would be the same or similar to Alternative B, although slightly fewer activities would likely lead to slightly fewer accidental events, and distancing would lead to less impacts to sensitive areas as spills could undergo increased weathering.

Economic Implications of Exclusion of the Proposed Rice's Whale Critical Habitat from OCS Oil and Gas Lease Sales: Exclusion of the proposed Rice's whale critical habitat (i.e., 100- to 400-m isobath) from a Gulf of Mexico OCS oil and gas lease sale is intended to protect the Rice's Whale, but at the cost of short and long-term economic benefits from oil and gas development. In the short term, the exclusion would redirect developers towards potentially less profitable opportunities. The last four OCS oil and gas lease sales show moderate industry interest, with only 31 blocks leased by both large and small operators in the area. If the Rice's whale critical habitat was not included as part of an OCS oil and gas lease sale, the long-term adverse impacts to economics could be greater. This is because the largest GOM fields have almost certainly been discovered and future discoveries are likely to be smaller fields. These smaller discoveries require co-development of subsea tiebacks in a hub and spoke type of development. Without potential future opportunities in the 100- to 400-m isobath, industry may view currently leased GOM acreage and existing facilities as less attractive for investment. Leases located on blocks that are fully or partially located in the excluded area currently contribute around 6 percent of oil and 11 percent of gas produced in the GOM. Platform owners in the excluded area, representing 5 percent of active GOM structures, would face reduced utilization of available capacity. Moreover, current leaseholders, with 161 active leases in the area and 5.7 percent of GOM wells drilled since 2013, could see diminished opportunities for development of their current leases due to a lack of tie-back opportunities. Despite the environmental benefits, these statistics highlight the economic challenges posed by the exclusion of this area from future OCS oil and gas lease sales.

Alternative C should be viewed in light of the ongoing OCS Oil and Gas Program, as well the numerous forces that can affect energy markets and the overall economy. Overall, Alternative C would minimally reduce beneficial impacts when compared to Alternative B, as well as further reduce the potential for adverse impacts from accidental events in the excluded areas. The actual impacts would be roughly proportional to the amount of resulting oil and gas industry activity as described above. Therefore, based on the description of the IPFs above and the scenario projections for a single proposed OCS oil and gas lease sale provided in **Chapter 3**, the impacts from IPFs associated with Alternative C on economic factors would range from **moderate adverse** to **moderate beneficial** for specific IPFs as discussed above, resulting in **minor** to **moderate beneficial** overall impacts when considered all together.

Alternative D – Targeted OCS Lease Sale Area with Additional Exclusions

Alternative D entails leasing a subset of the area considered in Alternative C by making additional areas unavailable for lease (**Chapter 2.2.4**). Therefore, the analyses for Alternative C (described above) cover the potential impacts of Alternative D from a regional perspective. While Alternative D further reduces the available areas for leasing, it is expected that production levels would be similar to Alternatives B and C as industry shifts to deeper water leases. Therefore, the overall economic impacts of Alternative D, from a regional perspective, would be very similar to the impacts of Alternative B or C.

However, the shift to deeper waters could have a disproportionate impact on operators that rely heavily on shallow-water operations (i.e., <200 m; 656 ft), as most acreage in this water-depth category would not be offered under Alternative D. Some of these impacts may be offset by shifting to other shallow-water locations (e.g., State waters or existing shallow-water leases), but this is unlikely to provide enough opportunity to substitute for all the adverse impacts that shallow-water focused companies might experience from cancellation of a single proposed OCS oil and gas lease sale. The exclusion areas under this alternative could also impact revenue sharing with states required under Section 8(g) of the OCSLA, which mandates that the Federal Government's share of 27 percent of leasing and development within 3 nmi (3.5 mi) of State boundaries. This analysis focuses exclusively on the implications of excluding these lease blocks from a single proposed OCS oil and gas lease sale and, thus, assumes these areas may be available for future lease sales. Consequently, the impacts of excluding them from a single OCS oil and gas lease sale may be limited as there would not be immediate impacts to production, and operators could make up production in the longer term if these blocks were available in future lease sales. If these blocks were also excluded from future lease sales; however, production within the 8(g) zone would likely decline over time which could, in turn, negatively impact the future revenue share appropriated to states. Therefore, based on the description of the IPFs above and the scenario projections for a single OCS oil and gas lease sale provided in **Chapter 3**, the impacts from IPFs associated with Alternative D on economic factors would range from **moderate adverse** to **moderate beneficial** for specific IPFs as discussed above, resulting in **minor** to **moderate beneficial** overall impacts when considered all together.

4.15.3 Incomplete or Unavailable Information

BOEM has identified incomplete or unavailable information that may be relevant to reasonably foreseeable impacts on economic factors. This information primarily relates to the onshore geographic distributions of economic impacts arising from the OCS Oil and Gas Program, which would allow BOEM to better estimate the impacts from routine activities and cumulative impacts. This information is difficult to obtain since most data sources do not adequately differentiate between onshore and OCS oil- and gas-related activities. In addition, standard data sources do not trace revenue and corporate profit streams to ultimate expenditures. BOEM used reasonably accepted scientific methodologies to extrapolate from existing information in completing the relevant analysis and formulating the conclusions presented here. For instance, BOEM utilized the CIM and LCIM to quantitatively assess the potential economic impacts of the OCS Oil and Gas Program where possible. Given there has not been a 4-year span between OCS oil and gas lease sales in the Gulf of Mexico, the consideration of both short- and long-term impacts from Alternative A is difficult to estimate or predict with a high degree of confidence using existing data and models. In the post-pandemic phase, there is inflationary pressure affecting companies, which often leads to higher costs for raw materials, labor, and other inputs. As a result, they may need to allocate more funds to produce the same goods or provide equivalent services. However, the full extent of the consequences stemming from these increased expenses remains uncertain. Although the incomplete or unavailable information may potentially inform the decisionmaking process, BOEM has concluded that such information is not crucial for making a well-informed choice among alternatives, given the generally positive nature of the economic impact of the OCS Oil and Gas Program. Moreover, the substitute information employed in lieu of the unavailable data has been deemed acceptable for this analysis. BOEM has diligently endeavored to adhere to the principles and objectives of NEPA, ensuring a comprehensive evaluation of potential environmental impacts.

4.16 SOCIAL FACTORS (INCLUDING ENVIRONMENTAL JUSTICE)

There is a strong relationship between the offshore oil and gas industry and the people and communities of the coastal regions of the five Gulf Coast States: Texas, Louisiana, Mississippi, Alabama, and Florida. The region is diverse in population, economic mix, available natural resources, and interaction with the offshore oil and gas industry. The presence of environmental justice populations, defined through Executive Orders 12898 and 14096 (which builds on Executive Order 12898 but does not replace it) as minority or low-income populations, warrants added attention to identify if they experience disproportionate environmental impacts, including human health and social and economic consequences. The oil and gas industry is widespread through the region but its density and composition vary geographically. This chapter serves to describe the holistic and interconnected nature of human activities in the area and their interactions with offshore oil- and gas-related activities.

4.16.1 Affected Environment

The area of interest for social factors analysis is the 133 coastal and near-coastal counties and parishes in the five Gulf Coast States. Population ranges in the counties/parishes of interest are provided in **Figure 4.16-1**. In Louisiana, there is also a shifting distribution of populations within parishes, increasingly concentrated towards the north ends of coastal parishes, as residents move away from the coast due to factors such as land loss, flooding, and loss of population and infrastructure (Austin et al. 2014b; 2022). In the GOM, the counties/parishes with the highest population density (persons per square mile) are Pinellas County, Florida (3,548); Harris County, Texas (2,742); Orleans Parish, Louisiana (2,308); Jefferson Parish, Louisiana (1,445); and Hillsborough County, Florida (1,420) (U.S. Census Bureau 2022a; 2022b). Three of the more populated counties/parishes that also have a high concentration of oil and gas industry are Harris County (Houston, Texas); and Orleans and Jefferson Parishes (Louisiana) (Dismukes 2024).

The racial and ethnic composition of the analysis area reflects both historical settlement patterns and current economic activities. The average percentage of minority residents throughout the area of analysis is 40.7 percent, which is slightly above the national average of 39.9 percent. Fifty-one counties/parishes have minority population levels above the national average. **Figures 4.16-2 and 4.16-3** illustrate the distribution of ranges of minority populations in Texas, Louisiana, Mississippi, Alabama, and Florida in relation to OCS oil- and gas-related infrastructure. Starr County, Texas, has the highest concentration of minority residents at 99.0 percent, while the lowest percentage is Cameron Parish, Louisiana at 9.8 percent (U.S. Census Bureau 2022b).

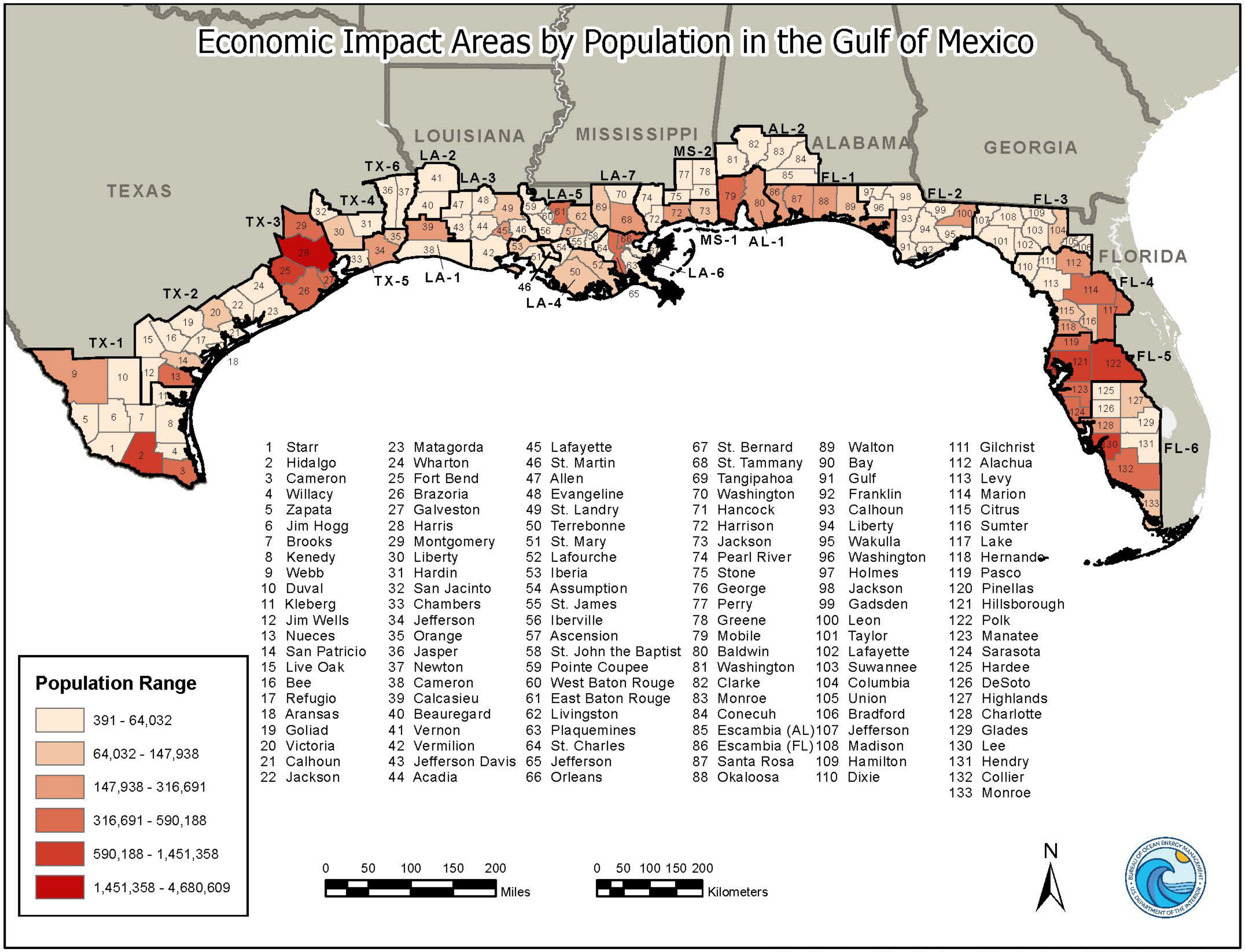

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Figure 4.16-1. Population of BOEM's Economic Impact Areas in the Gulf of Mexico.

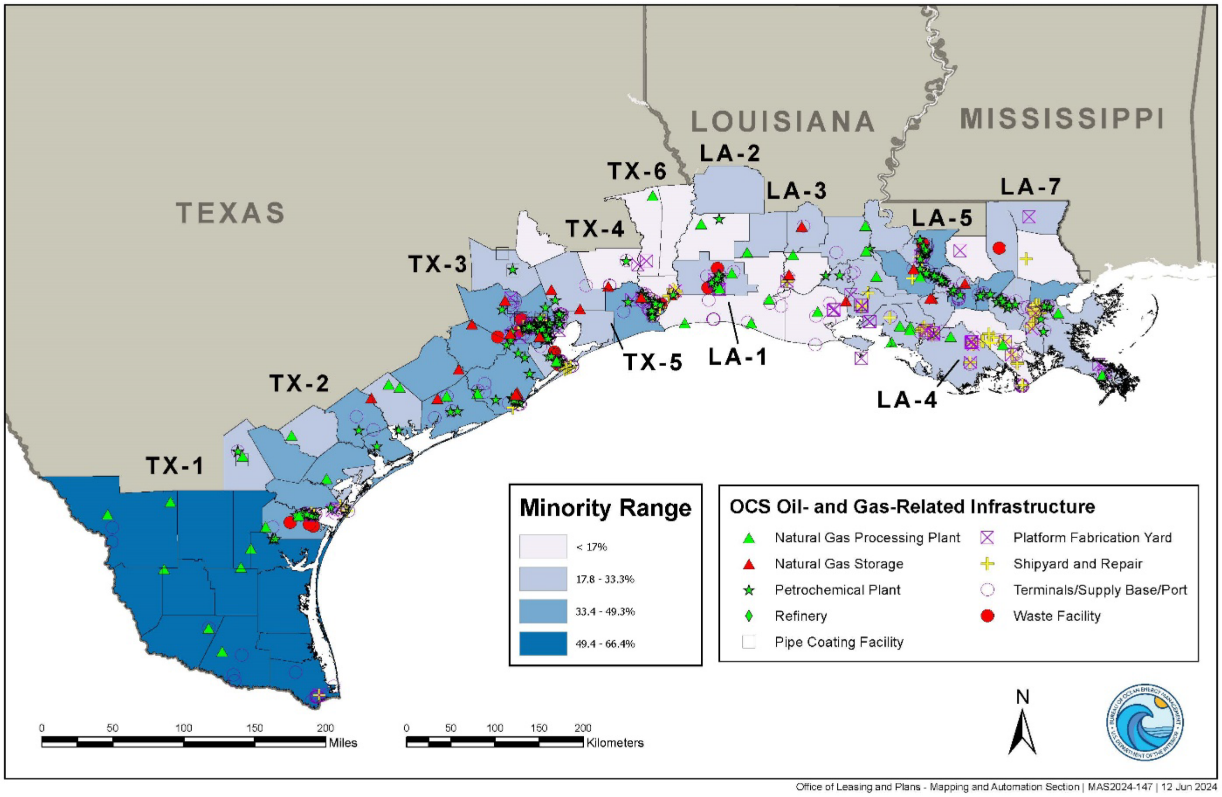

Figure 4.16-2. Percentage of Minority Populations in Texas and Louisiana in Relation to Onshore Infrastructure Supporting OCS Oil- and Gas-Related Activities.

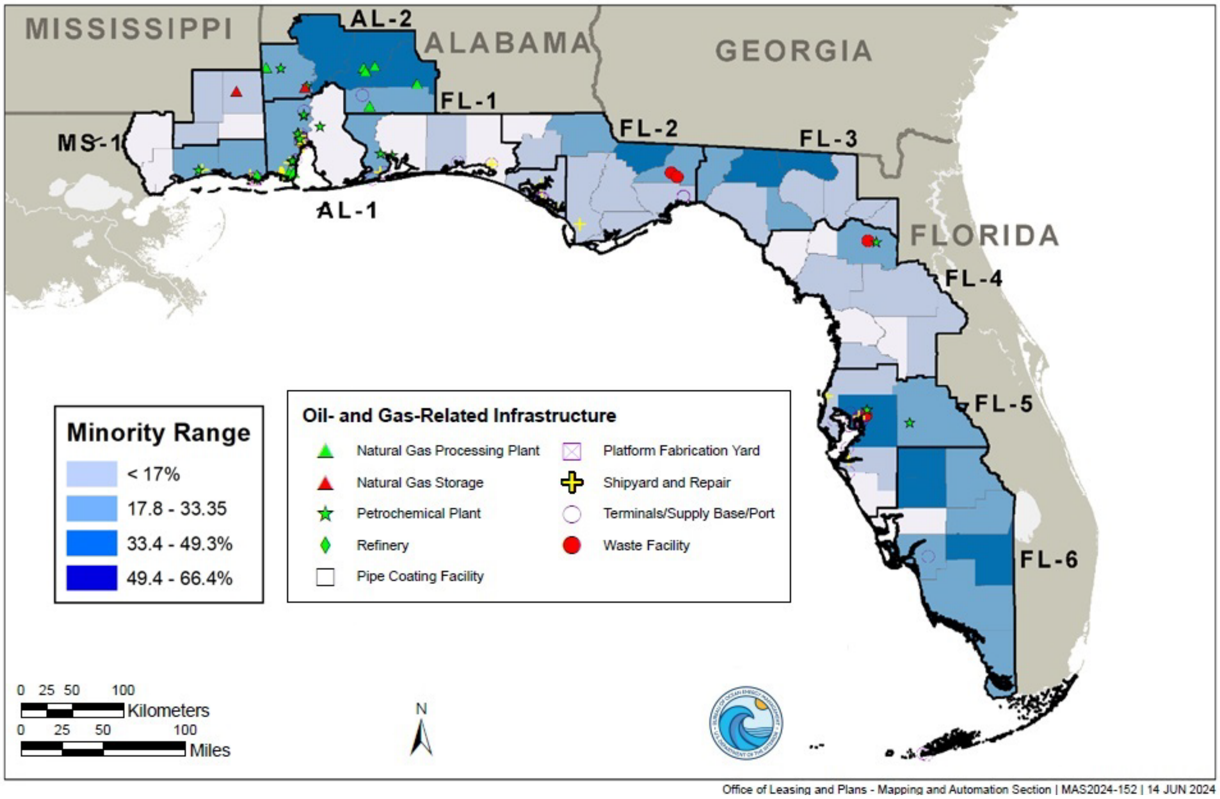

Figure 4.16-3. Percentage of Minority Populations in Mississippi, Alabama, and Florida in Relation to Onshore Infrastructure Supporting OCS Oil- and Gas-Related Activities.

Figures 4.16-4 and 4.16-5 illustrate the percentage of population below two times the national poverty level in Texas, Louisiana, Mississippi, Alabama, and Florida in relation to OCS oil- and gas-related infrastructure. Within the 133 counties/parishes, 111 counties/parishes have poverty levels above the national average of 29.8 percent. This is reflected in the regional average of 38.8 percent. The highest poverty rate is in Starr County, Texas (61.3%), and the lowest poverty rate is in Fort Bend County, Texas (19.7%) (U.S. Census Bureau 2022c). The presence of these racial and ethnic minority and low-income populations justify attention to environmental justice concerns.

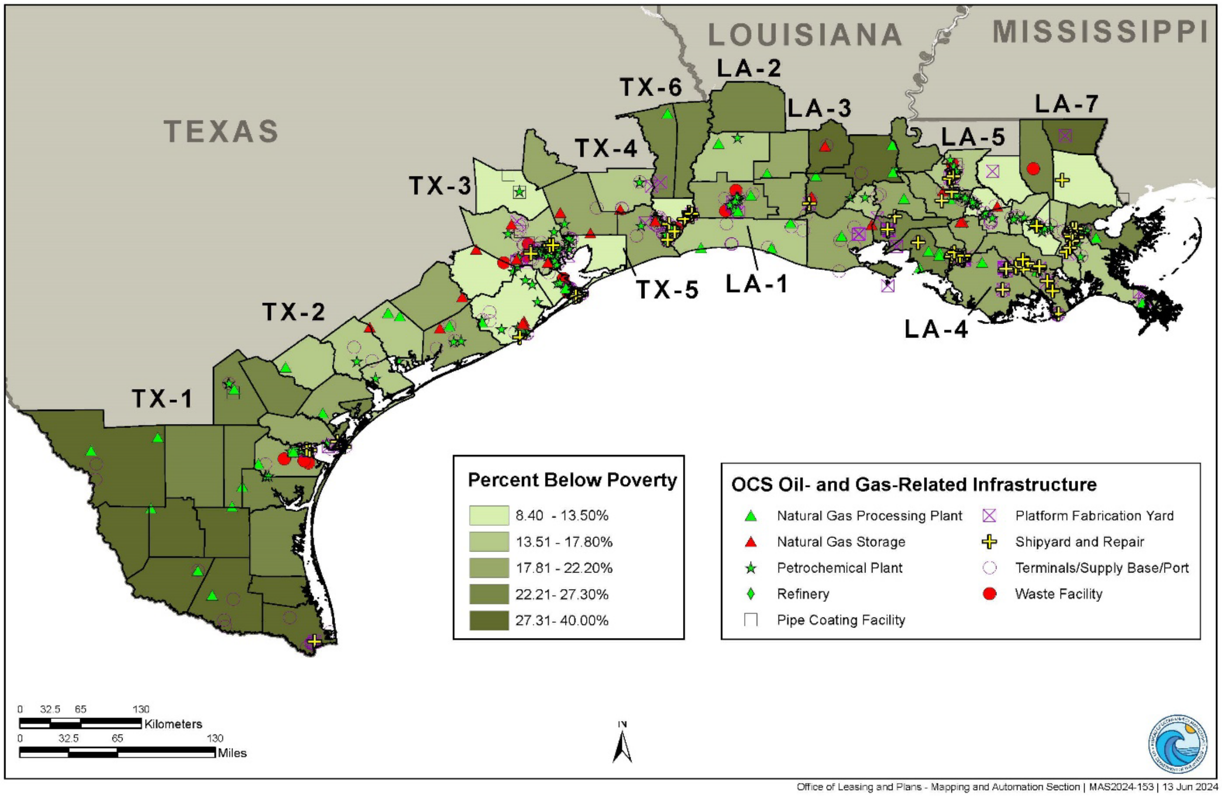

Figure 4.16-4. Percentage of Population Below Two Times the Poverty Level in Texas and Louisiana in Relation to Onshore Infrastructure Supporting OCS Oil- and Gas-Related Activities.

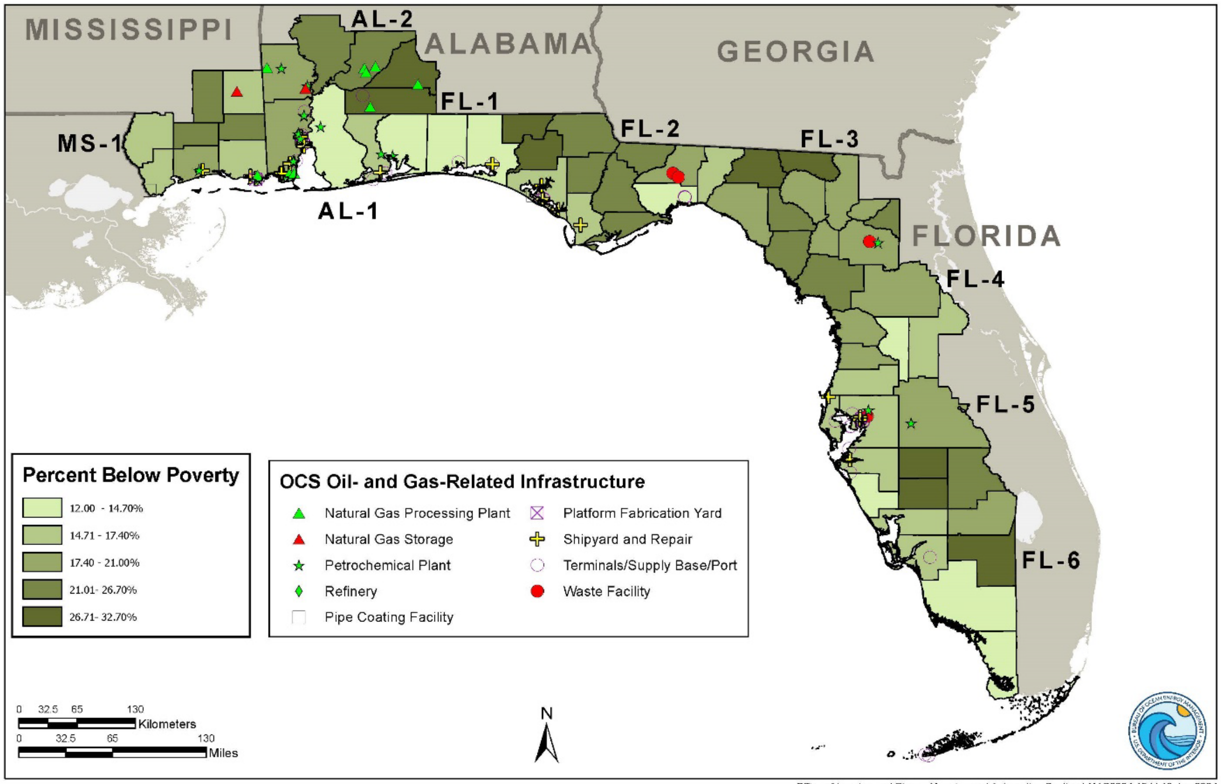

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Figure 4.16-5. Percentage of Population Below Two Times the Poverty Level in Mississippi, Alabama, and Florida in Relation to Onshore Infrastructure Supporting OCS Oil- and Gas-Related Activities.

4.16.2 Environmental Consequences

Social factors in the GOM are affected by existing environmental conditions, natural processes and phenomena, and human-induced factors such as harmful microorganisms, coastal land loss, major storm events, climate change, and the coronavirus pandemic as described in Chapter 4.4.6 of the GOM Oil and Gas SID. There are also several OCS oil- and gas-related and non-OCS oil- and gas-related IPFs that have the potential to impact social factors (**Table 4.16-1**). BOEM conducted an initial screening of IPFs in the GOM Oil and Gas SID and determined that air emissions and pollution, noise, socioeconomics, discharges and wastes, bottom disturbance, coastal land use/modification, lighting and visual impacts, offshore habitat modification/space-use, accidental events (unintended releases into the environment, response activities, and strikes and collisions), climate change, and natural processes could potentially impact social factors. Many of these IPFs can have direct, indirect, cumulative, or unknown benefits or adverse impacts to social factors and may be felt unevenly and by different social groups across the Gulf of Mexico region. These IPFs and their potential to affect social factors are discussed below and in greater detail in Chapter 4.4.6 of the GOM Oil and Gas SID. New information released since the development of the GOM Oil and Gas SID and relevant to the analysis is included in the applicable chapters below.

Table 4.16-1. Impact-Producing Factors with the Potential to Impact Social Factors.

OCS Oil- and Gas-Related Routine Activities	**OCS Oil- and Gas-Related Accidental Events**	**Non-OCS Oil- and Gas-Related Activities**
Air Emissions and Pollution	Unintended Releases into the Environment	Air Emissions and Pollution
Discharges and Wastes	Response Activities	Discharges and Wastes
Bottom Disturbance	Strikes and Collisions	Bottom Disturbance
Noise	-	Noise
Coastal Land Use/Modification	-	Coastal Land Use/Modification
Lighting and Visual Impacts	-	Lighting and Visual Impacts
Offshore Habitat Modification/ Space Use	-	Offshore Habitat Modification/ Space Use
Socioeconomic Changes and Drivers	-	Socioeconomic Changes and Drivers
-	-	Climate Change
-	-	Natural Processes
-	-	Other Cumulative Factors

There are several existing regulatory programs and requirements to reduce or minimize the effects of these IPFs to social factors in the GOM and the resources influencing them and are enforced by BOEM, BSEE, and other agencies. The *Gulf of Mexico OCS Regulatory Framework* technical report (BOEM 2020a) overviews the complex interconnected regulatory regime that exists around GOM activities. Lessees are required to perform OCS oil- and gas-related activities in accordance with regulatory requirements; therefore, the analysis factors in the mitigating effects of all applicable regulatory requirements as part of the proposed action when making impact determinations.

4.16.2.1 OCS Oil- and Gas-Related Impact-Producing Factors for Routine Activities

Air Emissions and Pollution: Air emissions and pollution, and routine discharges and wastes are regulated by BOEM and the USEPA, but they can still adversely affect human health as well as culturally and economically significant biological and archaeological resources tied to social factors and environmental justice. Air emissions and pollution are emitted by onshore facilities and waste and discharge disposal sites used to support the OCS oil- and gas-related activities. These onshore facilities are perceived as negative by neighbors, involve unpleasant odors, and are concerning to human health and reduced property values (**Chapter 4.1** of this Programmatic EIS and Chapters 2.2 and 4.4.1 of the GOM Oil and Gas SID contain additional information about onshore waste facilities.). Continuation of these onshore facilities can adversely affect social factors and nearby environmental justice communities.

Routine emissions from offshore facilities are typically done at a height that protects workers on those facilities, although downwash could expose personnel on vessels in the surrounding areas, such as commercial and recreational fishers and those working on supply vessels (Carter et al. 2023; Dahan et al. 2022; NASA Earth Observatory 2017). The Gulf of Mexico OCS is not a designated area for the NAAQS. However, the CAA and OCSLA authorize the USEPA and DOI (through BOEM), respectively, to regulate offshore emissions of criteria and their precursor pollutants to the extent that they significantly affect the air quality of any state. Air pollutants released from offshore sources can reach coastal communities. **Chapter 4.1** (Air Quality) discusses the various air pollutants associated with routine oil- and gas-related activities and how BOEM and USEPA regulate them.

Noise: Noise can negatively affect animal behavior, which in turn, could affect localized fishing activities, including subsistence fishing. Any notable adverse impacts to commercial (**Chapter 4.10**), recreational (**Chapter 4.11**), or subsistence fishing could have indirect adverse effects to social factors.

Socioeconomic Changes and Drivers: Socioeconomic changes and drivers associated with the existing OCS Oil and Gas Program have the potential to both negatively and/or positively affect social factors and environmental justice communities. These effects can vary in space and time, occur in varying degrees of intensity, can be simultaneous, or be one or the other depending on the specifics of any given situation, and are experienced at multiple, overlapping levels, including industry workers, support industry workers, families of workers, and the individuals and institutions that make up the communities at large. For example, Priest (2016) noted that the work structure of OCS oil- and gas-related industries (the long on-off schedules) augmented the continuation of the shrimping industry, an important identity marker in many coastal communities. Shrimping can also support resource sharing across social networks in what can commonly be referred to as subsistence practices, strengthening social ties and community identity and values (Regis and Walton 2022). Austin et al. (2002a; 2002b) describe the differences in sectors from the viewpoint of workers and their families, and they found that impacts are experienced at many different levels and intensities depending on what sector of the industry is involved. For example, workers in the oil and gas production sector enjoy more stable employment, while the drilling sector is volatile and provides less secure employment as it is more easily affected by fluctuations in oil and gas prices. Hemmerling et al. (2020) examined the relationship between the oil and gas industry and communities, noting that, while it has positive economic impacts, it has also increased community vulnerability to economic fluctuations.

Discharges and Wastes: Any notable degradation of water quality or habitat of species used commercially, recreationally, and for subsistence as a result of drilling discharges and produced waters could indirectly lead to negative effects to social factors. Some wastes from OCS oil- and gas-related activity are disposed of onshore in permitted facilities. This involves transportation routes and waste management facilities that can be perceived as negative by neighbors and can involve noxious or unpleasant odors, concerns about human health impacts from allowed or accidental releases, and reduced property values. Siting decisions for some past waste management facilities placed them near environmental justice communities, causing disproportionate effects to these communities. Onshore facilities that support OCS oil- and gas-related activities (as well as oil and gas activities onshore and in State waters) would be issued general or individual permits, from the USEPA or a USEPA-authorized State program, that limit discharges specific to the facility type and the waterbody receiving the discharge. Other wastes generated at these facilities would be handled by local municipal and solid-waste facilities, which are also regulated by the USEPA or a USEPA-authorized State program. **Chapter 3.4.2** has further discussion on discharges and waste related to routine oil- and gas-related activities; additionally, Chapter 2.2 of the GOM Oil and Gas SID contains a detailed description of offshore and onshore waste related to routine OCS oil- and gas-related activities and Chapter 4.4.1 of the GOM Oil and Gas SID contains a description of onshore waste disposal facilities and related regulations.

Bottom Disturbance: Bottom disturbance from routine OCS oil- and gas-related activities can adversely affect social factors and environmental justice by degrading habitats of species used commercially, recreationally, and for subsistence. Conversely, OCS oil- and gas-related structures could have positive effects by enhancing reef fish habitat and improving some fishing and diving opportunities. **Chapters 4.2, 4.3, 4.4, 4.5, 4.10, and 4.11** further detail direct and indirect impacts from bottom disturbance to resources that could potentially indirectly affect social factors (and environmental justice). Where appropriate, mitigating measures for bottom disturbances related to these resources are also identified and incorporated in the analyses below.

Coastal Land Use/Modification: Coastal land use from routine OCS oil- and gas-related activities can have positive or negative effects on social factors and environmental justice communities. For example, building or expanding oil and gas infrastructure on a coastal parcel could benefit workers in the OCS oil and gas industry and the local economy; however, it could negatively affect people who may have used the land for other purposes like recreation or subsistence by preventing economic gains associated with those uses. The shape, size, and impact of associated infrastructure varies on the landscape, so these effects are not equally distributed across the area of interest but are predominantly concentrated around centers of the oil and gas industry. Some environmental justice communities may be particularly sensitive to changes in coastal land use, as they may have special uses of those lands or be less able to make use of alternative places, and be less likely to benefit from development.

Hemmerling et al. (2021) examined 30 years of changing trends in exposure to risk (calculated using data and methods derived from the USEPA) in Louisiana’s coastal zone. They considered the full range of petroleum-related industrial infrastructure: shipbuilding and repair yards; onshore production and storage facilities; gas processing plants; refineries and petrochemical plants; and gas and petroleum pipelines to name several. Hemmerling et al. (2021) found that, at the beginning of the period they examined, there was a general trend toward diminishing levels of risk exposure in coastal Louisiana and other rural areas. However, in the coastal zone, this trend reversed, and the risk of hazard exposure intensified as the offshore petroleum industry intensified and this wider range of upstream and downstream industry industrial activities began to concentrate in the area. The authors note that, by the 2010 census, this increasing disproportionately impacted Native American and Asian populations on the coast and that overall Native American and Hispanic populations most disproportionately live in at-risk areas.

Lighting and Visual Impacts: The OCS oil- and gas-related lighting may disrupt the sense of place of a community or its recreational, cultural, historic, and archaeological resources and economically or culturally significant species. Environmental justice communities may be particularly sensitive to these disruptions if they have culturally significant relationships with those resources or are dependent on income associated with them.

Offshore Habitat Modification/Space Use: While placement of OCS oil- and gas-related infrastructure prevents competing uses within those areas, it provides additional locations for recreational fishing and can have positive effects by enhancing reef fish habitat and improving some fishing and diving opportunities. The absence or removal of OCS oil and gas structures, however, eliminates or alters potential recreational fishing locations but increases or leaves available areas for other uses (e.g., commercial trawling) (refer to **Chapters 4.10 and 4.11**). Therefore, the effects of structure presence or removal can be viewed as both negative or positive depending on the user group (e.g., commercial and recreational anglers).

4.16.2.2 OCS Oil- and Gas-Related Impact-Producing Factors from Accidental Events

Impacts from accidental events affect social factors directly through the disruption of everyday life and livelihoods (e.g., area closures due to spills) and through potential impacts to many of the resources described in other chapters (e.g., impacts to species utilized for seafood could influence socioeconomics and/or result in human health impacts).

Unintended Releases into the Environment: When oil is spilled in offshore areas, much of the oil evaporates or is dispersed by currents, so it has a low probability of contacting coastal areas but may negatively affect offshore activities such as fishing, recreation, or transportation by not allowing these activities to take place in the affected area or by negatively affecting the health or survival of the fish or other organisms in the area of the spill. Effects of unintended releases can be compounded if the spill impedes time-limited processes such as fishing seasons or cultural events such as fleet blessings, fishing rodeos, or other coastal-related festivals and gatherings. Environmental justice and subsistence-utilizing populations and Tribes may have additional vulnerabilities due to their particular circumstances or specificities of resource use. For example, to the extent that lower income and/or minority populations may rely on subsistence activities that could be impacted by an unintended release, they may be disproportionately impacted (see Austin et al. 2014b; Regis and Walton 2022).

A catastrophic event of a magnitude similar to the *Deepwater Horizon* explosion, oil spill, and response is not reasonably foreseeable and not part of the proposed action. Refer to **Chapter 3.5.1** for the range of potential spills (by size category) included as part of the reasonably foreseeable scenario for this analysis. For a detailed discussion of a low-probability, catastrophic oil spill, refer to the GOM Catastrophic Spill Event Analysis technical report (BOEM 2021c). Additionally, BOEM and others have sponsored research that has enhanced our understanding of the effects of catastrophic spills on social factors.

Specifically, regarding the ongoing social effects and understanding of the catastrophic *Deepwater Horizon* oil spill, ongoing research of that spill indicates that the recovery of fishermen has been uneven, full recovery has not yet been attained, and the coastal fishing communities in Louisiana have been faced with the most lasting negative impacts (Halmo et al. 2019). Research on coastal restoration activities following the *Deepwater Horizon* oil spill indicates that coastal restoration, the path a State was on before the catastrophe, influences how restoration will be conducted, leading to variability in processes and projects undertaken (Austin and Phaneuf 2020). Research is ongoing on the health impacts of the *Deepwater Horizon* oil spill (Croisant et al. 2017; Crossett et al. 2013; Gam et al. 2018; Kwok et al. 2017; McGowan et al. 2017; Nugent et al. 2019; Peters et al. 2017; Rung et al. 2016; Rung et al. 2017; Rung et al. 2019; Strelitz et al. 2018). New evidence indicates that exposure to dispersants were associated with increased prevalence of neurological symptoms among U.S. Coast Guard spill responders (Krishnamurthy et al. 2019).

A follow up to an earlier ethnographic study (Austin et al. 2014a; 2014b) on the *Deepwater Horizon* oil spill in multiple GOM communities found that half a decade later, the oil-spill event persisted in having social impacts across the GOM region (Austin et al. 2022). The social effects from the spill were enmeshed with other cumulative and ongoing effects in the region, including those from hurricanes, chronic land loss, dynamic economic conditions (especially among the seafood industry), and shifting demographics. Because of this, the specific effects of the spill were varied across the region, depending on local contexts. Additionally, the vast amount of continued research on the topic not only helped to keep the spill fresh in the minds of local communities and politicians but also the sheer amount of data surrounding heterogenous efforts, methodologies, and impacts contributed to uncertain conclusions about the spill and distrust among locals regarding continued research interests. Overall, uncertainty remained one of the greatest social impacts from the spill. As funding from the spill continues to be distributed, to both local peoples and to regional coastal protection and restoration efforts, the aftermath of the spill continues to impact the region.

Response Activities: Spill response can have both negative and positive effects on social factors, including environmental justice. Businesses and individuals involved in response activities (other than the responsible party) could see short-term economic gain, while those whose livelihoods or business plans are disrupted by the spill and its cleanup could see losses. Response activities can disrupt normal social and economic functioning, creating disruption and loss. Institutions may be unable to fulfill their normal functions because of their attention to the spill response.

Strikes and Collisions: Vessel collisions could have negative effects on social factors and environmental justice. Collisions may affect local populations as they can result in oil or chemical spills, as discussed above, and may interrupt fishing, transportation, and cultural activities along waterways or adjacent roadways.

4.16.2.3 Alternatives Analysis

Alternative A – No Action (Cancellation of a Single Proposed OCS Oil and Gas Lease Sale)

Under Alternative A, a proposed OCS oil and gas lease sale would not occur, so there would be no new routine activities or accidental events resulting from the proposed action. Therefore, no direct impacts to social factors would occur as a result of the proposed action (i.e., a single proposed OCS oil and gas lease sale). Impacts to social factors from the cancellation of a single OCS oil and gas lease sale would be **negligible** (mostly stemming from possible economic impacts; refer to **Chapter 4.15**). In areas where the oil and gas industry is deeply embedded in the cultural fabric (e.g., coastal parishes of Louisiana), the importance of this industry can go beyond employment and economics (Priest 2016). For example, a lack of new leasing could impact people who hold cultural values connected to oil- and gas-related industries if they become disassociated from them because of a loss of employment or income. However, because a regionwide lease sale would represent 0.3-1.8 percent of the overall Cumulative OCS Oil and Gas Program production in the GOM (**Table 3.3-1**), cancellation of a single OCS oil and gas lease sale would not be expected to result in a notable adverse impact to regional employment or other social factors.

Additionally, there are ongoing OCS oil- and gas-related activities and other non-OCS oil- and gas-related activities that contribute to the baseline environment (summarized in **Chapter 4.0.1** of this Programmatic EIS and described in detail in Chapter 3 of the GOM Oil and Gas SID) and would still occur. Ongoing activities associated with previous OCS oil and gas lease sales (**Table 3.3-2**) could still have potential direct and indirect impacts to social factors (including environmental justice) through air emissions and pollution, discharges and wastes, bottom disturbance, coastal land use/modification, noise, lighting/visual impacts, offshore habitat modification/space use, socioeconomic changes and drivers, unintended releases into the environment, response activities, and strikes and collisions as summarized above in **Chapter 4.16.2.2** and evaluated as part of the cumulative analysis in **Chapter 4.17.16**.

Comparison of Impacts Under Alternatives B, C, and D

A proposed regionwide OCS oil and gas lease sale under Alternatives B through D, and the resulting OCS oil- and gas-related activities from any subsequent leases, would result in air emissions and pollution, discharges and wastes, bottom disturbance, noise, coastal land use/modification, offshore habitat modification/space-use, socioeconomic changes and drivers, and accidental events that could potentially impact social factors. Alternative B represents the largest geographic area under consideration for a regionwide lease sale. Alternatives C and D represent geographical constraints on available acreage for leasing that could change the spatial distribution of the scenario activities but not the types of activities or overall activity levels. Therefore, this alternatives analysis is focused on the potential environmental impacts of a regionwide lease sale (Alternative B) and then considers if these potential impacts could be reduced or altered by the geographic constraints under Alternatives C and D.

Analyzing the impacts of routine OCS oil- and gas-related activities on people and communities is complex because they are experienced at multiple, overlapping levels (e.g., industry workers, families of workers, and the communities at large). The affected environment encompasses 133 counties across five states, containing an array of diverse demographics, cultures, economies, histories, and so on. Impacts occur in varying degrees of intensity. The interactions of industry and community are complex, resulting in a myriad of impacts, some positive and some negative. This complex relationship between the oil and gas industry and communities evolves over time, as do the subsequent impacts to these communities. Effects from OCS oil- and gas-related activities can be experienced as positive or negative, depending on the specifics of any given situation and parties affected, covering a broad spectrum of factors such as employment stability, wages and opportunities for advancement, economic rewards in exchange for work (benefits), work scheduling patterns and how these dictate time spent off the job or with families, industry cycles and fluctuations in OCS oil- and gas-related activity levels, demographic shifts (in-migration and out-migration), commuter and truck traffic, commodity (oil/gas) price fluctuations, expansions of existing infrastructure, and construction of new infrastructure.

Social factors covers a broad range of human dimensions, and impacts are experienced differently depending on specific location, people involved, situational context, and so on. Therefore, assigning specific impact determinations for each IPF category associated with *routine* activities would necessarily be a subjective exercise. However, **Table 4.16-2** does show the impact determinations for accidental events that could affect social factors for each action alternative analyzed. The impacts of Alternative A are not shown in **Table 4.16-2** because an oil and gas lease sale would not occur and the impacts for all IPFs from the proposed action would be avoided.

Table 4.16-2. Impact Determinations for Routine and Accidental Impacts to Social Factors for Alternatives B-D.

Impact-Producing Factor	BOEM's Protective Measure	Alternative B	Alternative C	Alternative D
Routine Activities	N/A	**Minor Beneficial** to **Negligible Adverse**	**Minor Beneficial** to **Negligible Adverse**	**Minor Beneficial** to **Negligible Adverse**
Unintended Releases into the Environment	N/A	**Negligible** to **Moderate Adverse**	**Negligible** to **Moderate Adverse** but could reduce the chance of spills reaching adjacent coastal areas, especially in Texas and western Louisiana	**Negligible** to **Moderate Adverse** but could reduce the chance of spills reaching adjacent coastal areas, especially in Texas and western Louisiana
Response Activities	N/A	**Negligible** to **Moderate Adverse**	**Negligible** to **Moderate Adverse** but could reduce the chance of spills reaching adjacent coastal areas (and subsequent response activities), especially in Texas and western Louisiana	**Negligible** to **Moderate Adverse** but could reduce the chance of spills reaching adjacent coastal areas (and subsequent response activities), especially in Texas and western Louisiana
Strikes and Collisions	N/A	**Negligible** to **Moderate Adverse**	**Negligible** to **Moderate Adverse**	**Negligible** to **Moderate Adverse**

Note: Alternative A is not shown in the table because the impacts from all impact-producing factors is **negligible**.

Alternative B – Regionwide OCS Lease Sale

Within the regionwide lease sale area under Alternative B, air emissions and pollution, discharges and wastes, bottom disturbance, noise, coastal land use/modification, offshore habitat modification/space-use, lighting and visual impacts, and socioeconomic changes and drivers could potentially impact social factors as described above in **Chapter 4.1.2.1**.

The potential impacts resulting from routine activities occur within the larger socioeconomic context of the GOM region. Routine activities related to a single lease sale would be incremental in nature, not expected to change existing conditions, and positive in their contribution to the sustainability of current industry, related support services, and associated employment. Existing onshore oil and gas infrastructure is expected to be sufficient to handle development associated with a proposed action (**Chapter 3.4.5**) and, thus, impacts from coastal land use would most likely be experienced from existing routine uses and not from novel construction. Based on the analysis of the IPFs above and the scenario projections for a single lease sale provided in **Chapter 3**, the overall impact of routine activities resulting from a single lease sale on social factors would be **minor beneficial** to **negligible**. The minor beneficial impact is because a lease sale could contribute to increased economic opportunity in upstream industries, such as fabrication yards, that could potentially influence social factors, but the impacts would be localized and ultimately unknowable at the time of an oil and gas lease sale.

Unintended Releases into the Environment: Oil spills that occur in coastal or nearshore waters have a greater chance of directly affecting people and communities, with impacts ranging from **negligible** to potentially **moderate adverse** in some communities. Based on historical oil-spill occurrence rate data, the majority of oil spills (>95%) have been less than 1 bbl (Anderson et al. 2012; Ji and Schiff 2023) and dissipate quickly and, thus, have **negligible** impacts with no effect or no measurable or detectable impacts on the social factors of an affected community (either geographically based or a community of practice). However, if the affected activity or community would have to adjust somewhat to account for disruptions due to notable and measurable adverse impacts or if remedial or mitigating measures are necessary before the affected community can return to conditions prior to an accidental event, then the impact would be **moderate adverse**. For example, in 2021 a large oil spill involving a pipeline occurred on the OCS off the coast of Orange County, California, resulting in beach closures, impacting a Pacific Airshow, initiating response efforts, and prompting ongoing restoration activities (all of which can directly and indirectly affect social factors) (NOAA 2023c). Conversely, on November 16, 2023, an underwater pipeline ruptured approximately 19 mi (31 km) off the coast of Louisiana and has since been sealed to prevent further leakage of oil (NOAA 2023b). As of February 2024 there has been no reported use of dispersants during response activities (NOAA 2023a) and there have been no reported wildlife or shoreline impacts (USCG 2023); however, investigation of the spill is ongoing.

Similarly, the impacts of chemical and drilling-fluid spills would range from **negligible** to **moderate adverse** depending on the location and characteristics of the event, with the likelihood of negative impacts increasing closer to shore.

Response Activities: Spill-response activities are expected to have **negligible** to **moderate adverse** impacts to various people and communities depending on the location and scale of the event and associated response activities. Small-scale, non-catastrophic spill events involve varying degrees of spill response and containment. For example, businesses and individuals involved in a response (other than the responsible party) could see economic gain, while those whose livelihoods or business plans are disrupted by the spill, and its cleanup would need to adjust their plans and could see economic losses (Austin et al. 2014a; 2014b).

Strikes and Collisions: Vessel collisions could affect local populations as they often result in oil or chemical spills and may interrupt transportation along waterways or roadways if a bridge is involved.

Unintended releases into the environment, response activities, and strikes and collisions associated with a proposed OCS oil and gas lease sale are not likely to be of sufficient scale or duration to have adverse and disproportionate long-term impacts for people and communities in the analysis area. **Chapter 3.5.1** further discusses the potential of accidental events from a proposed OCS oil and gas lease sale.

Based on the description of the IPFs above and the scenario projections for a single proposed oil and gas lease sale in **Chapter 3**, the overall impacts from routine OCS oil- and gas-related activities would range from **minor beneficial** to **negligible**, be widely distributed, and expected to have a limited impact because of the existing extensive and widespread infrastructural and economic support system for the petroleum industry and its associated labor force. The overall impact conclusion for accidental events on social factors range from **negligible** to **moderate adverse**.

Alternative C – Inflation Reduction Act Targeted OCS Lease Sale Area

Alternative C aims to concentrate leasing activities into a smaller footprint to potentially reduce impacts to ecologically sensitive areas and to preserve additional flexibility for marine spatial planning. These geographic constraints could change the spatial distribution of activities when compared to Alternative B but would not be expected to meaningfully change the types of activities or their overall levels. Therefore, the potential spatial redistribution of activity under Alternative C would not change the degree of overall effects to social factors because most impacts relevant to social factors occur onshore or nearshore, far from the OCS, and are widely distributed across the GOM. The IPFs and resulting impacts from routine activities would be **minor beneficial** to **negligible**, similar to Alternative B. The IPFs from accidental events would also be similar to Alternative B, ranging from **negligible** to **moderate adverse**, although the removal of the wind energy areas, SSRAs, and other blocks (**Figure 2.2.3-1**) could reduce the probability of some accidental events being experienced in adjacent coastal areas, especially in Texas and western Louisiana. Therefore, based on the description of the IPFs above and the scenario projections for a single proposed OCS oil and gas lease sale in **Chapter 3**, the overall impacts from IPFs associated with Alternatives C on social factors would range from **minor beneficial** to **moderate adverse**, be widely distributed, and expected to have a limited impact because of the existing extensive and widespread support system for the petroleum industry and its associated labor force.

Alternative D – Targeted OCS Lease Sale Area with Additional Exclusions

Alternative D aims to concentrate leasing activities into an even smaller footprint than Alternative C to potentially reduce impacts to additional ecologically sensitive areas and further preserve flexibility for marine spatial planning. These geographic constraints could change the spatial distribution of activities when compared to Alternatives B and C but are not expected to meaningfully change the types of activities or their overall levels. Therefore, the potential spatial redistribution of activity under Alternative D would not change the degree of overall effects to social factors because most impacts relevant to social factors occur onshore or nearshore, far from the OCS, and are widely distributed across the GOM. The IPFs and resulting impacts from routine activities would be **minor beneficial** to **negligible adverse**, unchanged from Alternative B. The IPFs from accidental events are also unchanged from Alternative B, ranging from **negligible** to **moderate adverse**, although the removal of the wind leasing call area, waters shoreward of the 20-m (66-ft) isobath, and SSRAs (**Figure 2.2.4-1**) could reduce the probability of some accidental events being experienced in adjacent coastal areas, especially in Texas and western Louisiana. Therefore, based on the description of the IPFs above and the scenario projections for a single proposed OCS oil and gas lease sale in **Chapter 3**, the overall impacts from IPFs associated with Alternatives D on social factors would range from **minor beneficial** to **moderate adverse**, be widely distributed, and expected to have a limited impact because of the existing extensive and widespread support system for the petroleum industry and its associated labor force.

4.16.3 Incomplete or Unavailable Information

There is information relevant to people and communities regarding the impacts of the *Deepwater Horizon* explosion, oil spill, and response that cannot be obtained within the timeframe contemplated for this Programmatic EIS because long-term health impact studies and the Natural Resource Damage Assessment restoration process are ongoing. Because long-term health impacts to coastal populations may be relevant to understanding the impacts from the *Deepwater Horizon* explosion, oil spill, and response to current and future baseline conditions, BOEM will continue to incorporate new information as it becomes available while analyzing the best information currently available. BOEM has used existing information and reasonably accepted scientific methodologies to extrapolate from available information in completing the relevant analysis, including information that has been released after the *Deepwater Horizon* explosion, oil spill, and response and studies of past oil spills, which indicate that a low-probability, catastrophic oil spill, which is not part of the proposed action, may have adverse impacts on residents in GOM coastal communities. For example, Austin et al. (2014b; 2022) probed the socioeconomic and sociocultural effects of the spill on specific GOM communities, and the synthesis of these results give insights to the overall regional impacts (refer also to Accidental Events in **Chapter 4.16.2.2** above). Research into possible long-term health impacts of the *Deepwater Horizon* explosion, oil spill, and response continues (Abramson et al. 2010; Substance Abuse and Mental Health Services Administration and CDC 2013; The National Institute of Environmental Health Sciences 2023).

Information on the long-term effects of recent hurricanes, such as Hurricane Ida, is also currently unavailable. Major hurricanes in the GOM have prompted demographic shifts and economic impacts. Studies of past hurricane impacts and responses, as well as the most currently available information on these recent hurricanes is considered (**Chapter 3.6.12**). Additionally, more specific connections between the potential health risks of personnel working on vessels in proximity to offshore facilities, as well as coastal communities' exposure to air pollutants related to routine oil- and gas-related offshore emissions, could be better explored in future research, especially in terms of location specificity and population exposure risks. Refer to **Chapter 4.1** for more information on potential air pollutants related to routine oil- and gas-related activities. Finally, obtaining detailed, location-specific information on environmental justice impacts, direct and indirect, from a proposed OCS oil and gas lease sale remains a challenge, as discussed more in **Chapter 4.16.2.4**. While relevant to this analysis, BOEM has determined that such information is not essential to a reasoned choice among alternatives based on the discussion above. BOEM has used the best available scientific information to date and reasonably accepted scientific methodologies to extrapolate from existing information. Therefore, the incomplete or unavailable information, while relevant, would not likely change the impact conclusions reached in this analysis and is not essential to a reasoned choice among alternatives.

4.16.4 Environmental Justice Determination

In accordance with 40 CFR §§ 1508.7 and 1508.8, BOEM has considered potential cumulative, direct, and indirect impacts to minority and low-income populations in the analysis area. Furthermore, in reaching this considered environmental justice determination, BOEM utilized guidance from CEQ (1997), USEPA (1998), and the NEPA Committee and Federal Interagency Working Group on Environmental Justice (2016).

Most of the OCS oil- and gas-related activities as a result of an OCS oil and gas lease sale are distant from human habitation, and would not have any direct impacts on low-income and minority populations. State offshore oil and gas leasing occurs in waters closer to land where petroleum-related activities are generally viewed as having a greater potential for directly impacting coastal communities. Indirect impacts to minority and low-income populations would occur onshore and would result from the operations of the extensive infrastructure system that supports all onshore and offshore OCS oil- and gas-related activities. This includes pipe coating, umbilical production, subsea equipment production, platform fabrication, shipbuilding and repair, exploration and production, crew transportation, product transportation, pipelines, above ground and underground storage and terminalling, exports, processing, refining, etc. Upstream infrastructure generally supports new developments, such as with platform fabrication, and this activity can generally be linked to the development of new leases. However, at the time of a lease sale the location of which upstream facilities might be utilized to support the development of the leased areas is unknown, and so an understanding of potentially impacted communities is unknown. Midstream and downstream infrastructure moves hydrocarbon product to market and includes gas processing facilities, petrochemical plants, transportation corridors, petroleum bulk storage facilities, and gas and petroleum pipelines. These components comprise a mature, widespread, and concentrated infrastructure system (refer to **Chapter 4.14.1**).

Much of this infrastructure is in coastal Louisiana and Texas, and to a lesser extent in Mississippi's Jackson County and Alabama's Mobile County. While many fabrication and supply facilities are concentrated around coastal ports, downstream processing is concentrated in industrial corridors farther inland (Dismukes 2011; Kaplan et al. 2011a; 2011b). The onshore downstream infrastructure exists to support all oil- and gas-related activities regardless of source (onshore, offshore, and imported product). The proportion of Federal OCS oil- and gas-related activities' contribution to downstream infrastructure use has not yet and, most likely, may never be possible to determine as it is dependent on highly unpredictable market demands and prices. Similarly, potential environmental justice impacts that may arise from downstream support activities associated with OCS oil- and gas-related activities are so attenuated from BOEM's decisionmaking and regulatory authority, it is difficult to discern the specific influence that BOEM's decisions have on these downstream support activities, including their location. Many other Federal and State agencies regulate onshore oil- and gas-related infrastructure through air and wastewater discharge permitting and stream and wetland permitting. Through these permitting processes, the Federal agencies are required to consider environmental justice impacts for their proposed Federal actions. Therefore, BOEM has determined that a proposed lease sale would not directly adversely affect minority and low-income populations.

However, indirect impacts might interact with other cumulative burdens unevenly throughout the study region and could potentially disproportionately affect environmental justice populations, although the particular contributions of a lease sale cannot measurably be determined with available information in regard to the location, extent, or severity of these impacts due to the complications discussed above. Some of the cumulative impacts to environmental justice communities are discussed in more detail in **Chapters 4.16.2.1 and 4.17.16**. Additionally, BOEM strives towards improving its environmental justice considerations through the development of Best Practices ongoing in our national office and hosting a series of Environmental Justice Technical Workshops in the Gulf of Mexico region. BOEM's Gulf of Mexico Region recently began a new study, "Cultural Heritage and Traditional Knowledge of Vulnerable Coastal Communities," to better understand the status of cultural heritage on Louisiana's coast, the threats to that heritage, and how coastal communities wish for State and Federal governments to consider that heritage in their planning and implementation efforts. As many of these coastal communities qualify as environmental justice populations (especially prevalent are Indigenous groups, African-American descendant communities, and those of Southeastern Asian descent), this effort would assist with filling an important data gap as it relates to the "social factors" of coastal Louisiana environmental justice groups and also serve as a resource for future consultations, outreach, and planning. While relevant to this analysis, BOEM has determined that such information is not essential to a reasoned choice among alternatives based on the discussion above. BOEM has used the best available scientific information to date and reasonably accepted scientific methodologies to extrapolate from existing information. Therefore, the incomplete or unavailable information, while relevant, would not likely change the impact conclusions reached in this analysis and is not essential to a reasoned choice among alternatives.

4.17 CUMULATIVE IMPACTS

This cumulative analysis incorporates by reference and builds upon the cumulative effects analysis provided in the 2024-2029 National OCS Oil and Gas Program Programmatic EIS (BOEM 2023b) to consider impacts to physical, biological, and socioeconomic resources that may result from the incremental impact of a single proposed OCS oil and gas lease sale when added to all past, present, and reasonably foreseeable activities. The past and present cumulative impacts were considered as part of baseline environmental conditions and are covered where relevant in the resource description and evaluation of impacts under the No Action Alternative above for each resource category. Chapters 2.8 and 4.3 of the 2024-2029 National OCS Oil and Gas Program Programmatic EIS discuss the current and future baseline conditions for the GOM, which remain applicable to this analysis and are incorporated by reference (BOEM 2023b). Overall, total OCS oil and gas production is expected to rise over the short-term but decrease and stabilize at a lower level over the next few decades (BOEM 2023c). It is reasonable to assume that GOM oil and gas lease sales would continue to be proposed for at least the next 10 years as described in **Chapter 3.6** based on resource availability and existing infrastructure. As such, routine OCS oil- and gas-related activities and accidental events associated with ongoing activities and reasonably foreseeable proposed OCS oil and gas lease sales are considered part of the cumulative analysis across all resources. Based on the scenario projections in **Chapter 3.3**, it is reasonable to assume that the future effects from the Cumulative OCS Oil and Gas Program would likely be similar to those in the past and under existing conditions.

Potential cumulative impacts, including the incremental contribution of the proposed action to cumulative impacts, are discussed below by resource category. While **Chapters 4.1-4.16** above discuss distinctions in impacts between action alternatives, when these differences among alternatives are evaluated in the context of all past, present, and reasonably foreseeable future activities, the cumulative impacts from the proposed action are expected to be similar under all of the action alternatives. Therefore, to avoid repetition, this analysis discusses cumulative impacts from the proposed action (i.e., a single proposed OCS oil and gas lease sale in the GOM) and is applicable for all action alternatives.

4.17.1 Air Quality

Cumulative impacts to air quality could result from air emissions and pollution associated with ongoing activities from previous OCS oil and gas lease sales (**Table 3.3-2**), as summarized above in **Chapters 4.1.2.1 and 4.1.2.2** and in greater detail in Chapters 4.1.2.2 and 4.1.2.3 of the GOM Oil and Gas SID. Air quality would likely continue to be degraded in some areas as major emissions sources, such as seaports, airports, vehicles, power plants, and industrial emissions, would likely continue to contribute to onshore NAAQS exceedances in the near term.

Air Emissions and Pollution: Air emissions and pollution from non-OCS oil- and gas-related activities influence air quality in the GOM. Chapter 2.1.2 of the GOM Oil and Gas SID discusses the non-OCS oil- and gas-related activities causing air emissions, including their estimated air emissions. Most of the CAP and CPAP emissions come from onshore sources, which contribute to the total CAP and CPAP annual emissions in the GOM – about 99 percent for SO_2, PM_{10}, $PM_{2.5}$, Pb, VOCs, NH_3, and CO, and about 91 percent for NO_x. For the HAP annual emission inventories, onshore sources contribute to the total HAP emissions in the GOM, about 95-99 percent for each of the 28 HAPs. For GHG annual emission inventories, onshore sources contribute to the total GHG emissions in the GOM, about 99 percent for CO_2, 88 percent for CH_4, and 96 percent for N_2O. The offshore non-OCS oil and gas source with the highest overall levels of air emissions was commercial marine vessels. A comparison of estimated emission from sources in the GOM is shown in **Table 4.17-1**. Future activities associated with renewable energy, such as vessels used for site assessment, would have sources of emissions from diesel and/or gasoline engines. Estimated annual emissions for reasonably foreseeable site characterization activities can be found in Chapter 3.3 of the *Commercial and Research Wind Lease and Grant Issuance and Site Assessment Activities on the Outer Continental Shelf of the Gulf of Mexico: Final Environmental Assessment* (BOEM 2023d).

Table 4.17-1. Comparison of Estimated Emissions from Sources in the GOM.

Air Pollutant	Total (tpy) from a Single OCS Oil and Gas Lease Sale – High Case (%)	Total (tpy) from OCS Oil and Gas Sources (%)	Total (tpy) from OCS Sources Other than Oil and Gas (%)	Total (tpy) from Onshore Non-OCS Oil and Gas Sources (%)
NO_x	0.151	3.151	6.159	90.538
PM_{10}	0.007	0.059	0.107	99.827
$PM_{2.5}$	0.023	0.193	0.335	99.449
NH_3	0.001	0.003	0.007	99.989
SO_2	0.043	0.202	0.756	98.999
Acetaldehyde	0.011	0.139	0.099	99.750
Benzene	0.018	0.662	0.101	99.219
Ethylbenzene	0.007	0.169	0.075	99.748
Formaldehyde	0.016	0.368	0.129	99.486
Hexane	0.053	3.133	0.095	96.720
Toluene	0.006	0.290	0.017	99.687
Xylenes	0.007	0.227	0.044	99.722
CH_4	0.164	11.368	0.117	88.351

Climate Change: Considering the timing and life cycle of the proposed action (i.e., a single OCS oil and gas lease sale), as well as the long-term and broad nature of changing climate, climate change effects are expected to be greater in the future. It is difficult to estimate future climate change impacts on air quality as other emission sources (e.g., biogenic and wildfire emissions) may change in the future from the effects of climate change. Even if the proposed action's emissions were to stop, the proposed action's contributions to future climate change would continue due to the long lifetimes of GHGs (Gevondyan et al. 2023). For example, the average lifetime of CH_4 in the atmosphere is about 12 years and CO_2 is hundreds of years (Gevondyan et al. 2023). While there is a myriad of efforts at the local, State, national, and international levels to promote the reduction of GHG emissions overall, current projections are that these emissions would still increase for the following decades adding to the current GHG concentrations in the atmosphere.

Other Cumulative Factors: Cumulative impacts also include when the air pollutants (the above analyzed CAPs, HAPs, methane, and nitrogen deposition) mix and co-exist over time, likely resulting in a greater adverse impact than the sum of the effects of each individual air pollutant in isolation. Urban areas along the Gulf Coast, such as the Houston-Galveston-Brazoria area that are currently experiencing nonattainment status for the 8-hr O_3 NAAQS could potentially experience a greater degree of cumulative effects given the higher density of air emission sources in those areas (Li et al. 2023). Currently, there is not enough information to draw conclusions about the long-term cumulative impacts of pollutants as they mix and react in the environment over the 40- to 70-year analysis period. However, more research is being conducted on multi-pollutant planning and control to better understand and manage cumulative effects (USEPA 2023e; 2023g) under the Clean Air Act and other statutes.

A single proposed OCS oil and gas lease sale, regardless of the alternative, would represent only a small portion of activity when compared to the existing OCS Oil and Gas Program in the GOM (refer to **Table 3.3-2**) and contribute less than 1 percent of the cumulative emissions annually in the Gulf of Mexico region when compared to all other sources (refer to **Table 4.17-1**). Accidental events would also contribute to the cumulative emissions. These emissions interact and contribute to ambient air pollution. In the context of past, present, and reasonably foreseeable OCS and non-OCS oil- and gas-related activities within the area of analysis, the *incremental contribution* (**Figure 4.0-1,** solid orange area) of a proposed GOM oil and gas lease sale to cumulative impacts on air quality would likely be **minor** to potentially **major** for certain areas. When considering the existing baseline conditions of the Houston-Galveston-Brazoria area are in nonattainment for O_3 and findings of high chemical O_3 production over the GOM by Li et al. (2023), cumulative impacts could be **moderate** to **major** if notable and measurable levels of O_3 caused by an OCS oil and gas lease sale were to reach the Houston-Galveston-Brazoria area, slowing down the long-term ability of the area to recover from chronic nonattainment status for O_3.

This Programmatic EIS evaluates air quality impacts by comparing annual contributions to relevant thresholds as opposed to the total combined sum of estimated emissions over the entire life cycle of a single proposed OCS oil and gas lease sale. Federal law thresholds like the NAAQS are inherently designed and established to protect public health and welfare from any adverse cumulative effects from all major contributing sources. It is important to note that, due to the uncertainty in actual activities from year-to-year, this analysis included consideration of potential emissions from the annual high case scenario as part of the range. The high case scenario encompasses all potential activity levels based upon historically high production. The annual high case scenario was applied to conservatively estimate the highest level of potential impacts that could occur within any given year over the 40-year analysis period. Actual single OCS oil and gas lease sale emissions, however, are unlikely to reach levels comparable to the annual high case scenario in any given year over the life of the leases issued. Throughout the lifespan for a single OCS oil and gas lease sale, emissions would occur over an extended period (e.g., releases are episodic over 40 years) and fluctuate in duration and locations based on the activities taking place.

The total cumulative emissions per pollutant over the lifespan of a single OCS oil and gas lease sale are shown in **Table 4.17-2**, where the estimated combined emissions from a high-case single OCS oil and gas lease sale would be distributed over 40 years. Analyzing impacts based on the total combined volume of emissions over the lifespan of a single OCS oil and gas lease sale, however, would be highly speculative and unreliable given the uncertainties in future meteorological conditions (which could worsen or improve cumulative air quality) and other complex variables influencing regional air pollution over long durations. In addition, total cumulative emissions were not analyzed because there are no scientific thresholds for a 40- to 70-year period to compare against the emissions from a single OCS oil and gas lease sale.

Table 4.17-2. Estimated Low- to High-End Range of Total Cumulative Emissions Over the Lifespan of a Single OCS Oil and Gas Lease Sale.

Air Pollutant	Total Emissions (low to high) from a Single OCS Oil and Gas Lease Sale (tons)
NO_x	633-12,424
PM_{10}	63-1,058
$PM_{2.5}$	59-1,000
NH_3	1-19
SO_2	88-1,353
Acetaldehyde	3-56
Benzene	1-28
Ethylbenzene	0-3
Formaldehyde	6-137
Hexane	0-61
Toluene	0-20
Xylenes	0-12
CH_4	1-12,368

4.17.2 Water Quality

Cumulative impacts to water quality could result from discharges and wastes, bottom disturbance, air emissions and pollution, and coastal land use/modification associated with ongoing activities from previous OCS oil and gas lease sales (**Table 3.3-2**) as summarized above in **Chapter 4.1.1** of this Programmatic EIS and in greater detail in Chapter 4.2 of the GOM Oil and Gas SID. Similar to the IPFs identified for routine OCS oil- and gas-related activities, non-OCS oil- and gas-related activities also influence water quality in the GOM through discharges and wastes, bottom disturbance, coastal land use/modification, and air emissions and pollution (**Chapter 3.6**).

Coastal Land Use/Modification: Residential construction, port expansions, and urbanization are expected to continue in the future as population increases along with shipping needs (Kildow et al. 2016; Merk et al. 2015; Sengupta et al. 2018).

Discharges and Wastes: Onshore support facilities could also produce discharges; however, effects from these discharges are expected to be minimized through compliance with NPDES permits to meet the requirements of the Clean Water Act and other regulatory requirements (BOEM 2020a).

Air Emissions and Pollution: Air emissions and pollution from non-OCS oil- and gas-related activities may affect water quality through uptake of atmospheric CO_2, but these effects are not well understood.

Bottom Disturbance: Temporary bottom disturbance may also occur from non-OCS oil- and gas-related activities such as commercial fishing, potentially increasing turbidity and resuspending sediments and thus potential contaminants into the water.

Natural Processes: Other IPFs or programmatic concerns that are reasonably foreseeable and could contribute to cumulative impacts to water quality, include eutrophication and hypoxia, sea-level rise, coastal erosion, natural seeps, trash and debris, land-based discharge sources, and climate change. In particular, natural seeps and land-based sources contribute oil slowly but cumulatively release more oil to the marine environment on an annual basis than the *Deepwater Horizon* oil spill (National Academies of Sciences, Engineering, and Medicine 2022b).

Eutrophication and hypoxia resulting from nutrient runoff, wastewater discharges, and river inputs are expected to continue contributing to cumulative impacts on water quality. Marine debris and microplastics are of increasing concern for GOM water quality and are found throughout the water column and come from a variety of sources, with Mississippi River discharge as a major input into the GOM (Di Mauro et al. 2017; Kane et al. 2020; Lecke-Mitchell and Mullin 1997; Wessel et al. 2016). Microplastics and larger marine debris can introduce toxic chemicals into seawater as they decompose and break down, but the potential cumulative water quality impacts of this remain largely inconclusive (Ziccardi et al. 2016).

Climate Change: The observed rise in ocean temperature over the last century is expected to persist in the future and will continue to impact climate, ocean circulation, chemistry, and ecosystems (Doney et al. 2014). Climate change factors that are known to influence water and sediment chemistry include increasing ocean acidification (pH), increasing sea-surface temperatures, and storm activity. Climate change would promote changes in flushing regimes, freshwater inputs, and water chemistry, and would influence how these changes could affect ecosystem services, particularly along the coast (Cabral et al. 2019). Climate change may also increase stratification, which, in turn, could exacerbate hypoxia (Rabalais and Turner 2019). BOEM provides a larger discussion on climate change in **Chapter 3.6.3**.

Another byproduct of increased atmospheric CO_2 is ocean acidification. This is an increasingly important issue regarding water quality in the Gulf of Mexico, particularly along the coasts (Cai et al. 2011; Hu et al. 2015). Climate change contributes to ocean acidification, which, in turn, can impact chemical and biological aspects of the marine environment and affect oceanic carbon sequestration (Hofmann and Schellnhuber 2009). Modeled calculations suggest pH decreased from 1863 to 2003 in the region (Andersson et al. 2019). In the GOM open ocean, the partial pressure of CO_2 at the ocean surface is increasing at rates consistent with trends observed at long-term ocean time series stations (Kealoha et al. 2020). This increase in partial pressure corresponds to an increase in atmospheric CO_2 absorption into the ocean, with ocean acidification as a result. Along with a warming ocean and the air-sea CO_2 flux, the Loop Current is a major basin-scale driver of ocean conditions that can also affect acidification in the GOM (Osborne et al. 2022).

The National Center for Atmospheric Research conducted a modeling study of the impacts of climate change on Gulf of Mexico hurricane intensity and frequency (Bruyère et al. 2017). That study found a tendency towards fewer hurricanes in the GOM and a slight reduction in the proportion of Atlantic hurricanes entering the GOM; an increased proportion of Category 3, 4, and 5 storms; and similar size and track speed of future hurricanes when compared to current ones. Higher intensity storms, coupled with higher sea levels, could increase coastal flooding and erosion, degrade coastal habitats, and have significant impacts on the resuspension and distribution of bottom sediment (Wren and Leonard 2005). If storm frequency and intensity increase (Chapter 3.4.2 of the GOM Oil and Gas SID), the additional disturbance of sediment may increase cumulative impacts to water quality in nearshore and coastal areas. However, there currently is not a consensus on the extent that climate change may impact hurricane frequency, with no significant trend so far in the Atlantic since 1900 (NOAA 2012; 2023d). An increase in Atlantic hurricane intensity has been observed over several decades, but the relationship between this and anthropogenic climate change requires more research (Knutson et al. 2021; Kossin et al. 2020).

Under any action alternative, a single proposed OCS oil and gas lease sale would represent only a small portion of activity when compared to the existing OCS Oil and Gas Program in the GOM (**Table 3.3-2**). In the context of past, present, and reasonably foreseeable OCS and non-OCS oil- and gas-related activities within the area of analysis, the *incremental contribution* of a proposed GOM lease sale to cumulative impacts on water quality would be **negligible** when applicable regulations are properly followed and enforced. Based on the analysis above, an OCS oil and gas lease sale would not be expected to result in, or have a notable or measurable contribution to, any new or ongoing significant cumulative impacts not already being experienced by water quality in the area of analysis.

4.17.3 Coastal Communities and Habitats

Cumulative impacts to coastal communities and habitats could result from discharges and wastes, bottom disturbance, coastal land use or modification, unintended releases into the environment, and response activities associated with previous OCS oil and gas lease sale activities, as summarized above in **Chapter 4.3.2.3** of this Programmatic EIS and in greater detail in Chapter 4.3.1 of the GOM Oil and Gas SID. Similar to the IPFs identified for routine OCS oil- and gas-related activities, non-OCS oil- and gas-related activities also influence coastal communities and habitats in the GOM. These activities are grouped into four IPF categories: air emissions; discharges and wastes; bottom disturbance; and coastal land use or modification. The content under each IPF heading below summarizes the more relevant detailed discussion of how non-OCS oil- and gas-related activities can affect coastal communities and habitats found in Chapter 4.3.1.2.1 of the GOM Oil and Gas SID.

Air Emissions and Pollution: Air emissions and pollution result from ongoing and future OCS oil- and gas-related activities, State oil- and gas-related activities, and other anthropogenic and natural sources (refer to **Chapters 3.4.1 and 3.6.4** for examples). As discussed in **Chapter 4.1**, however, OCS oil- and gas-related sources contribute a small percentage to the emissions received onshore near coastal habitats and communities. In addition, most of these emissions are localized and would dissipate quickly. Therefore, BOEM expects that coastal communities and habitats would not be vulnerable to air emissions from routine OCS oil- and gas-related activities. Other anthropogenic activities, such as fossil fuel combustion and agriculture, release large amounts of nitrogen, sulfur, and carbon into the atmosphere. In the form of nitrogen, sulfur, and carbon oxides and ammonia, these chemicals can disrupt the chemistry of coastal soils and surface waters, leading to reduced pH (i.e., acidification). Acidified waters may hinder growth of calcifying organisms such as oysters (Osborne et al. 2022). In addition to altering local pH, atmospheric deposition of sulfur and nitrogen oxides enhance nutrient loads in coastal ecosystems. Current atmospheric deposition rates are presented in **Chapter 4.1**. In moderation, nutrient enrichment may enhance growth for some coastal vegetation types. However, severe nutrient loading can cause eutrophication of coastal waters downwind of anthropogenic emissions, leading to algal blooms and shifts in biological diversity (Howarth et al. 2000; Paerl 1997; Paerl et al. 2002). Algal blooms diminish water clarity and, in some cases, lead to toxic conditions and loss of SAV (Bittick et al. 2018; Kennicutt II 2017). Elevated concentrations of carbon dioxide in the atmosphere, including from anthropogenic sources, may act as a fertilizer and stimulate plant production, although the response is variable and influenced by local environmental factors.

Discharges and Wastes: Cumulative inputs of discharges and wastes including, but not limited to, fresh water, wastewater, stormwater runoff, grey water from vessels, chemical wastes, nutrients (e.g., nitrogen and phosphorus), dredged material, State oil and gas discharges, and other materials (e.g., trash and including plastics) affect the coastal GOM marine environment. These inputs can alter salinity and increase turbidity and organic material in coastal waters (Bianchi et al. 2010). Degraded water quality can negatively affect vegetation in wetlands and seagrass beds, which can lead to increased shoreline erosion and loss of habitat. Excess nutrients in the water can have large-scale ecological consequences on the coastal and estuarine habitats of the GOM. In the Mississippi-Atchafalaya basin, high organic and inorganic nutrient loads cause eutrophication, which in turn can lead to low-oxygen (hypoxic) conditions that kill or displace many species and lead to “dead zones” through an intermediate step of microbial consumption of settled out phytoplankton blooms (Bianchi et al. 2010; Rabalais et al. 2002). Plastics are commonly found in coastal habitats, including beaches and wetlands, and can similarly degrade localized habitat quality as described earlier (**Chapter 4.3.2.2**). Accidental oil spills can also occur from ongoing State oil- and gas-related activities, resulting in similar effects to coastal communities and habitats as described earlier (**Chapter 4.3.2.2**).

Bottom Disturbance: Bottom disturbance can occur from cumulative activities such as vessel and buoy anchoring, moorings, military operations, artificial reef emplacement, dredging, trawling, State oil- and gas-related activities, and renewable energy site assessment and characterization (e.g., geotechnical/sub-bottom sampling, and biological surveys). Anchoring may crush coastal habitats such as SAV, oyster beds, or coastal coral reefs. Dredging of coastal waterways and ports may also result in the crushing of coastal benthic habitat or smothering via increased turbidity and sedimentation. Increased turbidity from bottom disturbance may also limit the amount of light available for SAV. Inshore commercial fishing activity (e.g., trawling) can also cause increased turbidity and resultant sedimentation, potentially smothering benthic habitat.

Coastal Land Use/Modification: Coastal land use/modification can occur from cumulative activities such as onshore construction (e.g., hotels, seawalls, bridges, roads, oil- and gas-related facilities), vessel traffic (e.g., oil- and gas-related activities, shipping, recreational and commercial fishing, and cruise ships), and dredging of navigation canals. These activities can result in coastal habitat and hydrologic alteration, increased turbidity and sedimentation of nearby waterways, and vessel-induced wave erosion. These impacts may result in a net altering of ecosystem function, potentially creating suboptimal conditions for coastal communities and habitats such as oyster reefs, marsh grasses, and SAV.

***Climate Change*:** Climate change is expected to have profound effects on marine ecosystems worldwide, including coastal communities and habitats. Higher water temperatures associated with increased anthropogenically-sourced CO_2 lead to sea-level rise, increased ocean stratification, deoxygenation, and eutrophication of coastal waters, and altered patterns of ocean precipitation, circulation, and freshwater input (Doney et al. 2012; Rodgers 2021). Sea-level rise along the Gulf Coast over the next three decades is projected to be, on average, 14-18 in (36-41 cm) (Sweet et al. 2022). This may result in permanent flooding or isolating of coastal habitat, rendering it unsuitable for its associated communities. Tropical storms and cyclones (especially hurricanes) may increase in intensity due to climate change. These storms and cyclones introduce fresh water and nutrients, and increase storm surge, flooding, and physical damage in coastal areas (Bruyère et al. 2017; Patrick et al. 2020). Ocean acidification (i.e., reduction in ocean pH) can hinder the growth of calcium carbonate shells in shellfish, although responses can vary among and within species (Osborne et al. 2022). The eastern oyster (*Crassostrea virginica*) may be particularly vulnerable under prediction scenarios (Osborne et al. 2022), causing concern for the function of this important benthic habitat in coastal areas of the GOM.

A single proposed OCS oil and gas lease sale, regardless of alternative, would represent only a small portion of activity when compared to the existing OCS Oil and Gas Program in the GOM (refer to **Table 3.3-2**). In the context of past, present, and reasonably foreseeable OCS and non-OCS oil- and gas-related activities within the area of analysis, the *incremental contribution* of a proposed GOM lease sale to cumulative impacts on coastal communities and habitats would be **negligible** to **minor** when properly regulated. Based on the analysis above, an OCS oil and gas lease sale would not be expected to result in, or have a notable or measurable contribution to, any new or ongoing significant cumulative impacts not already being experienced by coastal communities and habitats in the area of analysis.

4.17.4 Benthic Communities and Habitats

Cumulative impacts to benthic communities and habitats, including protected corals, could result from bottom disturbance, discharges and wastes, offshore habitat modification/space use, unintended releases into the environment, response activities, and strikes and collisions associated with ongoing activities from previous OCS oil and gas lease sale activities (**Table 3.3-2**), as summarized above in **Chapter 4.4.1.2** and in greater detail in Chapters 4.3.2.2.2 and 4.3.2.2.3 of the GOM Oil and Gas SID. The following cumulative analysis also considers installation and decommissioning of infrastructure as part of the OCS Oil and Gas Program. Decomissioning analysis includes removal and decommissioning in place as discussed in **Chapter 3.2.5**.

Similar to the IPFs identified for routine OCS oil- and gas-related activities, non-OCS oil- and gas-related activities also influence benthic communities and habitats, including ESA-listed corals and designated coral critical habitat, in the GOM. These activities are grouped into three IPF categories: bottom disturbance; discharges and wastes; and offshore habitat modification/space use. The content under each IPF heading below summarizes the more relevant detailed discussion of how non-OCS oil- and gas-related activities can affect benthic communities and habitats found in Chapter 4.3.2.2.1 of the GOM Oil and Gas SID.

Bottom Disturbance: The majority of non-OCS oil- and gas-related effects to benthic communities and habitats result from bottom-disturbing activities. These activities include artificial reef development, scuba diving, buoy placement (including renewable energy site assessment equipment), anchoring, fishing activity (trawling), and State oil and gas activities.

The primary anthropogenic activity that may contribute to non-OCS oil- and gas-related effects to benthic communities is fishing. Commercial bottom-tending fishing gear of any type (e.g., trawls, traps, bottom-set longlines, and gillnets) can damage benthic communities by dislodging or crushing organisms attached to the bottom, with trawls representing the most serious threat in deep water (Hourigan 2014). Regarding recreational fishing, anchoring for fishing vessels is currently prohibited within the boundaries of the Flower Garden Banks National Marine Sanctuary and within the McGrail Bank Coral Habitat Area of Particular Concern. However, many important topographic features are found near established shipping fairways and anchorage areas and are well-known fishing areas. Vessel anchoring at a topographic feature or bank may result in crushing of hard substrates and structure-forming organisms (e.g., corals and sponges), burial of organisms, and scarring of the seafloor. The extent of effects from non-OCS oil- and gas-related anchoring activities on nonprotected benthic communities and habitats is unknown.

The placement of artificial reefs within the context of State artificial reef programs has the potential to cause bottom disturbance, including the crushing and/or burial of sessile organisms. However, as the purpose of artificial reef development is to create hard substrates and benthic habitat where it does not naturally exist, artificial reef development is not expected to significantly impact hard bottom benthic communities and habitats. Buoys may be placed to collect meteorological or hydrographic data, support scuba diving operations, mark navigation hazards, or provide boat moorings to protect benthic resources, and may similarly crush or bury benthic communities and habitats. Buoy lines also have the potential to be snagged by passing vessels or carried by powerful storms, dragging anchors across the seafloor. However, buoy placement may be temporary and most, if not all, buoys are regularly monitored and maintained. Anchoring and structure emplacement (e.g., pipelines) from ongoing Federal or State oil and gas activities could also affect benthic communities in the same way as described earlier under this proposed action.

Scuba diving activities may affect benthic communities and habitats through crushing or fracturing by divers or dive boat anchors, or removal of organisms. In some areas where such diving does occur (e.g., the Flower Garden Banks National Marine Sanctuary), the activity is managed by other Federal agencies, with regulations and management practices developed to protect benthic resources.

Discharges and Wastes: Primary sources of adverse impacts to benthic communities resulting from non-OCS oil- and gas-related discharges and wastes include fresh water, toxic chemicals, nutrients, vessel discharge, and anthropogenic debris from the Mississippi and Atchafalaya River Basins into north-central GOM waters. Most of these effects are likely to occur within the coastal zone. Discharges and wastes in the coastal zone can bury and/or smother benthic habitat and associated organisms, and the organisms can be exposed to toxins within the discharges. Benthic communities exposed to non-OCS oil- and gas-related discharges and wastes may suffer reduced survival, fecundity, and growth; reduced community abundance; and reduced species richness. Terrestrial floodwater containing fresh water, toxic chemicals, nutrients, and other anthropogenic debris from large hurricane events may impact mid-shelf and shelf edge topographic banks and features on the OCS.

Oil and gas activities within State waters occur offshore Texas, Louisiana, Mississippi, and Alabama. The potential effects to benthic communities and habitats from unintended releases into the environment resulting from State-permitted oil and gas activities include death as well as sublethal effects such as reduced feeding, reduced reproduction and growth, physical tissue damage, and altered behavior. These effects from State oil and gas activities are the same as those that could occur for OCS oil- and gas-related unintended releases to the environment.

Offshore Habitat Modification/Space Use: The introduction of invasive species associated with benthic hard bottom habitat have the potential to cause benthic habitat modification. Invasive lionfish (*Pterois volitans*) first arrived in the Gulf of Mexico in 2010 and currently inhabit the coasts of all five Gulf Coast States as well as artificial and natural reefs. Their density, feeding patterns, growth rate, and lack of predators have the potential to significantly affect benthic communities, potentially leading to habitat modification. The result would be a decrease in biodiversity and abundance of many of the smaller organisms that use the seafloor habitats found on topographic features. An ulcerative skin disease impacting lionfish was first observed in late 2017 and 2018 and has resulted in an overall density decline of the species (Harris et al. 2020), which may mitigate their overall effect on benthic communities. The invasive Regal Demoiselle (*Neopomacentrus cyanomos*) has been recorded on the Flower Garden Banks (Johnston et al. 2020). Potential effects from its spread are currently unknown; however, they are unlikely to have any unusual ecological advantages over native species (Robertson et al. 2016).

Artificial reefs may enhance biological productivity and facilitate the conservation and/or restoration of benthic organisms by restricting access to other bottom-disturbing activities such as bottom trawling (Macreadie et al. 2011). Microalgae and nearly all invertebrate taxa (i.e., corals, anemones, hydroids, sponges, bivalves, mollusks, and polychaetes) have been observed on artificial reefs (summarized in Macreadie et al. 2011). Over long distances, artificial reefs may act as "stepping stones" across areas with little to no natural hard substrate that act to increase connectivity with biogeographical consequences (summarized in Cordes et al. 2016).

Climate Change: Climate change-related effects include ocean acidification, rise in water temperature, changes in water circulation patterns and chemistry, increased storm activity, sea-level rise, and habitat modification or loss. These changes may affect marine GOM ecosystems by increasing the vertical stratification of the water column, shifting prey distribution, impacting competition, and generally impacting species' ranges (Learmonth et al. 2006). Shallow benthic communities and habitats, including protected corals, may be damaged through bottom disturbance induced by storms (e.g., hurricanes), and by ocean acidification. All climate change-related effects can have cascading effects on marine ecosystems because they may act additively or synergistically with other IPFs, including those introduced by OCS oil- and gas-related activities (Doney et al. 2012).

A single proposed OCS oil and gas lease sale, regardless of alternative, would represent only a small portion of activity when compared to the existing OCS Oil and Gas Program in the GOM (refer to **Table 3.3-2**). In the context of past, present, and reasonably foreseeable OCS and non-OCS oil- and gas-related activities within the area of analysis, the *incremental contribution* of a proposed OCS oil and gas lease sale to cumulative impacts on benthic communities and habitats, including protected corals, would be **negligible** when properly regulated and mitigated. Based on the analysis above, an OCS oil and gas lease sale would not be expected to result in, or have a notable or measurable contribution to, any new or ongoing significant cumulative impacts not already being experienced by benthic communities and habitats in the area of analysis.

4.17.5 Pelagic Communities and Habitats

Table 3.3-2 presents projections of the major activities and impact-producing factors (e.g., structure [platform, subsea] installations, structure removals; well exploration, development, and production; service vessel trips) related to future Cumulative OCS Oil and Gas Program activities. Cumulative impacts to pelagic communities and habitats, including *Sargassum*, could result from air emissions and pollution, discharges and wastes, bottom disturbance, noise, lighting and visual impacts, offshore habitat modification/space use, unintended releases into the environment, response activities, and strikes and collisions associated with ongoing activities from previous OCS oil and gas lease sale activities (**Table 3.3-2**), as summarized above in **Chapter 4.5.2.3** and in greater detail in Chapters 4.3.3.2.2 and 4.3.3.2.3 of the GOM Oil and Gas SID.

Similar to the IPFs identified for routine OCS oil- and gas-related activities, non-OCS oil- and gas-related activities also influence pelagic communities and habitats, including *Sargassum*, in the GOM. These activities are also grouped into seven IPF categories: air emissions; discharges and wastes; bottom disturbance; noise; lighting and visual impacts; offshore habitat modification/space use; and strikes and collisions. The content under each IPF heading below summarizes the more relevant detailed discussion of how non-OCS oil- and gas-related activities can affect pelagic communities found in Chapter 4.3.3.2.1 of the GOM Oil and Gas SID.

Air Emissions and Pollution: The potential impacts of air emissions from non-OCS oil- and gas-related activities, including natural (e.g., bacterial processes and natural oil seeps) and anthropogenic sources (e.g., commercial and fishing vessel traffic and State water oil and gas activities), are the same as for OCS oil- and gas-related activity analyzed under Alternative B and include the potential to indirectly affect pelagic waters through the absorption of CO_2.

Discharges and Wastes: Discharges and wastes resulting from anthropogenic point-source activities (e.g., sewage treatment discharge) are regulated (e.g., NPDES), localized, and expected to dissipate (i.e., return to baseline conditions) quickly. Alternatively, effects from non-point discharges and waste sources (e.g., agricultural runoff) are often not localized and can have large-scale implications (e.g., hypoxic events). However, effects of these non-point sources primarily occur nearshore of the OCS. The potential impacts of discharges and wastes from non-OCS oil- and gas-related activities are the same as for OCS oil- and gas-related activity analyzed under Alternative B and include exposure to contaminants and turbidity.

The potential impacts of unintended releases into the environment and response activities from non-OCS oil- and gas-related activities (e.g., State water oil and gas activities and commercial and fishing vessels), are the same as for OCS oil- and gas-related activity analyzed under Alternative B. Unintended releases into the environment include the potential to affect pelagic habitat quality and function and associated communities, including *Sargassum,* through toxic effects or the prevention of light penetration. Response activities include the potential to cause injury/mortality of plankton in the area (e.g., burning and chemical dispersants). Further, response activities could also remove and/or concentrate plankton and *Sargassum* into affected areas (e.g., booms).

Bottom Disturbance: The potential impacts of bottom disturbance from non-OCS oil- and gas-related activities (e.g., trawling, buoys/mooring anchors, and renewable energy site characterization geotechnical surveys) are the same as for OCS oil- and gas-related activity analyzed under Alternative B and include near seafloor turbidity.

Noise: The potential impacts of underwater noise from non-OCS oil- and gas-related activities, including natural (e.g., animals, wind, and rain) and anthropogenic sources (e.g., commercial and fishing vessels and renewable energy site characterization geological and geophysical surveys), are the same as for OCS oil- and gas-related activity analyzed under Alternative B and include both indirect (e.g., area avoidance) and direct (e.g., body malformations) effects.

Lighting and Visual Impacts: potential impacts of artificial lighting from non-OCS oil- and gas-related activities (e.g., navigational lighting and commercial and fishing vessels) are the same as for OCS oil- and gas-related activity analyzed under Alternative B and include the attraction of organisms and/or alteration of normal diel migration patterns.

Offshore Habitat Modification/Space Use: The potential impacts of offshore habitat modification/space use from non-OCS oil- and gas-related activities (e.g., State water oil and gas activities and renewable energy site assessment buoys) are the same as for OCS oil- and gas-related activity analyzed under Alternative B and include creating habitat that would otherwise not exist within the water column and possible altering of normal migration patterns and predator/prey interactions.

Strikes and Collisions: Potential impacts of strikes and collisions from vessels from non-OCS oil- and gas-related activities (e.g., commercial and fishing vessel traffic and military operations) are the same as for oil- and gas-related activity analyzed under Alternative B and include fragmentation of *Sargassum* and injury/mortality to plankton.

Climate Change: Other IPFs or programmatic concerns not already discussed as part of existing conditions, but which are reasonably foreseeable and could contribute to cumulative impacts to pelagic communities and habitats, include climate change and ocean acidification. Climate change can influence water temperature and chemistry. In addition, it can affect weather patterns, influencing surface hydrodynamics. Ocean acidification from increased CO_2 absorption or sulfur and nitrogen deposition can impact pelagic pH levels, resulting in potential physiological (e.g., larval development) effects and alterations to food web dynamics. The changes may act additively or synergistically within other IPFs and have species- and life stage-specific effects. However, within the open waters of the GOM these changes (e.g., increased sea surface temperature, sea-surface height anomalies, and wind speed) have not generally resulted in changes to primary production over a 20-year period (Li et al. 2022; Muller-Karger et al. 2015) with the exception of the Mississippi River Delta area where an increase in chlorophyl-a concentration has been found with the controlling factor (e.g., nutrients and mixing) unclear (Li et al. 2022).

A single proposed OCS oil and gas lease sale, regardless of alternative, would represent only a small portion (0.3-1.8%) of activity when compared to the overall Cumulative OCS Oil and Gas Program activity forecasted to occur in the GOM (**Table 3.3-2**). In the context of past, present, and reasonably foreseeable OCS and non-OCS oil- and gas-related activities within the area of analysis, the *incremental contribution* of a proposed Gulf of Mexico OCS oil and gas lease sale to cumulative impacts on pelagic communities and habitats, including *Sargassum*, would be **negligible** when properly regulated. Based on the analyses above, an OCS oil and gas lease sale would not be expected to result in, or have a notable or measurable contribution to, any new or ongoing significant cumulative impacts not already being experienced by pelagic communities and habitats in the area of analysis.

4.17.6 Fishes and Invertebrates

Cumulative impacts to fishes and invertebrates could result from discharges and wastes, bottom disturbance, noise, coastal land use/modification, lighting, offshore habitat modification/space use, unintended releases into the environment, response activities, and strikes and collisions associated with previous OCS oil and gas lease sale activities, as summarized above in **Chapter 4.6.2.3** of this Programmatic EIS and in greater detail in Chapter 4.3.4 of the GOM Oil and Gas SID. Similar to the IPFs identified for routine OCS oil- and gas-related activities, non-OCS oil- and gas-related activities also influence fishes and invertebrates in the GOM. Cumulative activities are grouped into seven IPF categories: air emissions; discharges and wastes; bottom disturbance; noise; coastal land use/modification; lighting; and offshore habitat modification/space use. The content under each IPF heading below summarizes the more relevant detailed discussion of how non-OCS oil- and gas-related activities can affect fishes and invertebrates found in Chapter 4.3.4.2.1 of the GOM Oil and Gas SID.

Air Emissions and Pollution: Air emissions may result from cumulative activities, including State oil and gas activities, natural sources, commercial and recreational vessels (including fishing vessels), and military vessels and aircraft. The indirect absorption of these emissions in the GOM could occur and lead to localized changes in water quality (e.g., acidification from CO_2 absorption), negatively affecting habitat suitability for fishes and invertebrates, including ESA-listed species.

Discharges and Wastes: Cumulative inputs of discharges and wastes such as fresh water, wastewater, stormwater runoff, chemical wastes, nutrients (e.g., nitrogen and phosphorus), State oil and gas discharges, and other materials (e.g., plastics) may affect habitat suitability for fishes and invertebrates, including ESA-listed species, by causing changes in salinity, turbidity, and organic material load in coastal waters (Bianchi et al. 2010). Pollutants can bioaccumulate in the marine trophic web, and permitted discharges of bilge can result in the introduction of invasive species. Discharges can induce hypoxia and assist in the proliferation of toxic dinoflagellates, which can cause "red tide" events along the Gulf Coast and elsewhere, and lead to mass mortalities in fishes and invertebrates. Microdebris pollution and ingestion can also harm fishes and invertebrates through emaciation and toxicity.

Bottom Disturbance: Bottom disturbance can occur from activities such as vessel and buoy anchoring, moorings, military operations, artificial reef emplacement, dredging, trawling, mass wasting, ongoing and future State oil and gas activities, and renewable energy site assessment and characterization (e.g., geotechnical/sub-bottom sampling, and biological surveys). Potential effects to fishes and invertebrates, including ESA-listed species, are similar to those described for OCS oil- and gas-related activities (e.g., physical crushing and increased turbidity). For example, commercial fishing gear, such as bottom trawls, can damage benthic habitats that support fishes and invertebrates and result in mortality of non-targeted species (i.e., bycatch).

Noise: Noise from cumulative activities is introduced into the marine environment from natural (e.g., wind-driven waves and animal sounds) and anthropogenic sources (e.g., commercial shipping, commercial fishing, State oil and gas, and renewable energy activities [e.g., HRG survey equipment]). Noise from these sources could be continuous or pulsed, be quite ubiquitous, and result in negative effects to fishes and invertebrates, including ESA-listed species, similar to those described earlier (e.g., masking of biologically important signals, temporary or permanent hearing loss, and mortality).

Coastal Land Use/Modification: Coastal land use and modification from cumulative activities include dredging of navigation canals, coastal construction (e.g., State oil and gas facilities, pipeline landfalls, tourism, and residential infrastructure), and vessel traffic. These activities can impact fishes and invertebrates, including ESA-listed species, in similar ways as described earlier for OCS oil- and gas-related discharges and wastes (e.g., reduced water quality), bottom disturbance (e.g., crushing and increased turbidity), and noise (e.g., masking from vessel traffic). The alteration of coastal habitats also results in potential loss of important habitats for fishes and invertebrates (e.g., habitat that serves as nursery grounds).

Lighting: Lighting from cumulative activities (e.g., vessels, private homes, fishing piers, restaurants, industry-related infrastructure, and oil and gas structures) all emit light at night into coastal waters. Effects to fishes and invertebrates are similar to those described earlier for OCS oil- and gas-related activities (e.g., altering community composition, concentrating predators near lit surface waters, and modifying schooling and predatory behavior).

Offshore Habitat Modification/Space Use: The non-OCS offshore habitat modification/space use results from cumulative activities such as structure emplacement (e.g., artificial reefs, military equipment, and navigational aids), and commercial and recreational fishing. Structure emplacement may result in effects as described earlier for OCS oil- and gas-related structures (e.g., community structure shifts, changes in predator/prey interactions, changes to migratory patterns, invasive species spread, and increased injury or mortality from recreational and commercial fishing). While improvements in fishery management techniques and science have been able to improve stock levels for many commercially and recreationally valuable species, bycatch from these fishing activities can negatively impact other ecologically important species (i.e., through reductions in prey biomass). Additionally, commercial fishing gear can damage benthic habitats that support fishes and invertebrates, leading to effects as described earlier for bottom disturbance.

Climate Change: Global climate change is expected to have profound effects on marine ecosystems worldwide. Range expansions of tropical fishes may continue to occur and have the potential to alter the ecology of existing ecosystems, including food web and habitat interactions (Fodrie et al. 2010; Fujiwara et al. 2019; Purtlebaugh et al. 2020). Warming waters may continue to result in land loss and sea-level rise, altering habitat in coastal areas that many fishes and invertebrates utilize during some or all of their lives. Ocean acidification resulting from climate change can hinder growth and weaken the shells of bivalves and affect the growth and physiology of fishes at different life-history stages (Llopiz et al. 2014; Osborne et al. 2022). The overall impacts to fishes and invertebrates, including ESA-listed species, from climate change over the 50-year span of the proposed action would potentially alter distributions of fishes and invertebrates from warming waters and negatively affect their habitat quality and extent through land loss and sea-level rise.

A single proposed OCS oil and gas lease sale, regardless of alternative, would represent only a small portion of activity when compared to the existing OCS Oil and Gas Program in the GOM (**Table 3.3-2**). In the context of past, present, and reasonably foreseeable OCS and non-OCS oil- and gas-related activities within the area of analysis, the *incremental contribution* of a proposed GOM lease sale to cumulative impacts on fishes and invertebrates, including ESA-listed species, would be **negligible** to **minor** when properly regulated and mitigated. Localized impacts to habitat extent and quality and the richness or abundance of species in an area may occur, but it is not anticipated that the overall fitness of fishes and invertebrate populations would be impacted. Based on the analysis above, an OCS oil and gas lease sale would not be expected to result in, or have a notable or measurable contribution to, any new or ongoing significant cumulative impacts not already being experienced by fish and invertebrates in the area of analysis.

4.17.7 Birds

Table 3.3-2 presents projections of the major activities and impact-producing factors (e.g., structure [platform, subsea] installations, structure removals; well exploration, development, and production; and service vessel trips) related to Cumulative OCS Oil and Gas Program activities. Cumulative impacts to birds could result from discharges and wastes, noise, coastal land use/modification, lighting and visual impacts, offshore habitat modification/space use, unintended releases into the environment, response activities, and strikes and collisions associated with ongoing activities from previous OCS oil and gas lease sale activities (**Table 3.3-2**), as summarized above in **Chapter 4.7.2.1** of this Programmatic EIS and in greater detail in in Chapters 4.3.5.2.2 and 4.3.5.2.3 of the GOM Oil and Gas SID.

Similar to the IPFs identified for routine OCS oil- and gas-related activities, non-OCS oil- and gas-related activities also could impact birds in the GOM. These non- OCS oil- and gas- related activities are grouped into six IPF categories: discharges and wastes; noise; coastal land use/modification; lighting and visual impacts; offshore habitat modification/space use; and other IPFs (i.e., climate change, anthropogenic activities, predation, and disease). The content under each IPF heading below summarizes the more relevant detailed discussion of how non-OCS oil- and gas-related activities could influence birds found in Chapter 4.3.5.1.2 of the GOM Oil and Gas SID.

Discharges and Wastes: The USEPA regulates certain discharges (e.g., bilge or ballast water from ships and industrial discharges into the coastal atmosphere). Agricultural nutrient and pesticide run-off also occur in the GOM. Pollutants are expected to be safely disposed of or diluted to below harmful levels to birds as water is not their preferred habitat. The discard of trash and debris from non-OCS oil- and gas-related sources (e.g., State oil- and gas-related activities, recreational fishing boats, and land-based sources) is prohibited. However, unknown quantities of plastics and other materials are discarded despite regulation and subsequently lost in the marine environment. Nutrient contributions to the GOM via the Mississippi River watershed cause seasonal population explosions of phytoplankton, which decompose to create a hypoxic or anoxic “dead zone” over the continental shelf. Hypoxic zones can impact coastal waterbirds’ aquatic prey sources. However, no massive phytoplankton blooms have been reported to produce massive mortality to coastal and marine birds in the zone. Birds can move away from impacted areas to find sufficient food, and the effects from these blooms would be short term.

Noise: Noise has the potential to mask communication, displace birds from important breeding or foraging areas, disturb predator-prey interactions, and cause noise-induced threshold shifts (Crowell 2016). Birds are known to have a relatively restricted hearing range for airborne noise, with acute sensitivity occurring in the range of 1 to 5 kHz (Dooling and Popper 2007). Less is known about the auditory hearing range of birds underwater; however, some studies suggest their greatest hearing sensitivity underwater ranges from 1 to 3 kHz (Crowell et al. 2015; Hansen et al. 2017; McGrew 2019). Military activities, including training overflights, occur in designated areas offshore that also serve as seabird habitat. The U.S. Air Force and U.S. Navy conduct most military operations in the GOM in areas federally designated for training, research, testing, and evaluation activities. A study found that weapons testing noises had no significant effects on bald eagle activity or reproduction (Brown et al. 1999). Aircraft noise can also affect birds, but studies have shown that bird exposure to frequent, low-level military jet aircraft and simulated mid- to high-altitude sonic booms resulted in some short-term behavioral responses with little effect on reproductive success (Ellis et al. 1991).

Coastal Land Use/Modification: Ongoing and projected wetland loss results in the loss of essential habitats for coastal and marine birds. Wetlands serve as vital breeding and nesting grounds for adult birds and rearing grounds for juveniles. These habitats provide drinking water and feeding, resting, shelter, and community opportunities for several species of birds. As discussed in Chapter 4.3.1.1 of the GOM Oil and Gas SID, historical wetland loss due to Mississippi River hydromodification would be improved by wetland creation from Atchafalaya River sediments and coastal restoration and hurricane protection programs. Habitat (e.g., wetland) loss, alteration, and fragmentation associated with building, factory, and road construction are mitigated by USACE and State wetland permitting regulations to keep from harming sensitive bird habitat. Non-consumptive recreation that could impact birds includes beach use during bird-watching activities, riding in all-terrain vehicles, and walking and jogging with pets. All forms of beach use may cause birds to become stressed and fly away, with varying degrees of response for individual species.

Lighting and Visual Impacts: Lighting could impact birds and, in the GOM region, State oil and gas platforms provide sources of artificial lighting in State waters. Attraction to artificial lighting could impose energetic costs to individual birds as well as collision risk with the structures, which could result in injury or mortality. Artificial lighting at night can disorient birds, especially offshore migrators. Poor weather conditions (e.g., fog, precipitation, and low cloud cover) could further increase birds' attraction to lighting, especially at dusk or during a full moon (Miles et al. 2010; Rodríguez and Rodríguez 2009).

Offshore Habitat Modification/Space Use: Non-consumptive recreation that could impact birds includes recreational boating, which may cause birds to become stressed and fly away, with varying degrees of response for different species. Ongoing State oil- and gas-related activities include the presence of platforms in waters that are traveled by migrants in the spring and fall, which could lead to collisions and nocturnal circulations. Additionally, reasonably foreseeable renewable energy activities in the OCS of the GOM include those associated with site characterization and site assessment. These specific activities are not likely to cause effects to birds per a separate programmatic FWS consultation (refer to the 2018 FWS BiOp and **Appendices A and E** of this Programmatic EIS).

Climate Change: Climate change could impact marine and coastal birds. Though climate change impacts on birds are difficult to predict, changes in climate may influence bird's ecology through changes in habitat ranges (Jodice et al. 2021; Mustin et al. 2007), increased risk of predation and competition, exposure to different prey and parasites, shifts in seasonal events (e.g., breeding and migration) forcing life cycles out of synchrony with prey sources, changes to local food webs, and/or habitat alterations (Butler and Taylor 2005; Liebezeit et al. 2012; Tillmann and Siemann 2011; Wauchope et al. 2017; Wormworth and Mallon 2006). Climate change may impact a wide range of aspects of a bird's ecology, and the question remains as to whether specific species can shift to new habitat ranges (Mustin et al. 2007) as range contractions are expected to occur more frequently than range expansions. Ocean acidification can also alter food web dynamics. Ocean acidification alters pH levels, which can affect sensitive planktonic species at the organismal level up to a population-level response due to food web dynamic changes, which could lead to impacts on marine and coastal bird prey. Biodiversity is vital to the ecosystems that support all bird life (McDaniel and Borton 2002). Global environmental change may also increase the frequency and intensity of hurricanes, which could possibly worsen damage to important breeding and wintering habitats in the northern GOM (NOAA 2023d).

Natural Processes: Birds are vulnerable to predation from cats, which typically occurs on their nesting grounds. There are currently no regional estimates for annual mortality rates from predation of domestic cats. National estimated annual mortality from predation by free-ranging domestic cats is 1.3-4.0 billion birds per year (Loss et al. 2013).

Emerging infectious diseases are a threat to native bird species and a signification cause of nearshore and coastal bird mortality (Newman et al. 2007). Diseases, such as the West Nile Virus, can have widespread and long-term effects on landbird populations (George et al. 2015; LaDeau 2007). Majority of the studies are continental level estimates; however, estimates can be qualitatively extrapolated to other species as well as the northern GOM, where West Nile virus and potentially other infectious diseases would be expected to have severe impacts on avian populations.

Other Cumulative Factors: Seabird populations can be impacted by other anthropogenic activities. Commercial fisheries may overexploit prey, which can result in severe constraints for seabird abundances (Furness and Tasker 2000; Grémillet et al. 2018; Paleczny 2012). Nutritional conditions of prey are essential to seabird reproductive success and population dynamics as well (Lamb 2016).

A single proposed OCS oil and gas lease sale, regardless of the alternative, would represent only a small portion of activity (0.3-1.8%) when compared to the existing OCS Oil and Gas Program in the GOM (**Table 3.3-2**). In the context of past, present, and reasonably foreseeable OCS and non-OCS oil- and gas-related activities within the area of analysis, the *incremental contribution* of a proposed OCS lease sale to cumulative impacts on birds, including protected birds, would be

negligible when properly regulated. Based on the analysis above, an OCS oil and gas lease sale would not be expected to result in, or have a notable or measurable contribution to, any new or ongoing significant cumulative impacts not already being experienced by birds in the area of analysis.

4.17.8 Marine Mammals

Cumulative impacts to marine mammals could result from noise, offshore habitat modification/space use, bottom disturbance, unintended releases into the environment, response activities, and strikes and collisions associated with ongoing activities from previous OCS oil and gas lease sale activities (**Table 3.3-2**), as summarized above in **Chapter 4.8.2.3** and in greater detail in Chapters 4.3.6.2.2 and 4.3.6.2.3 of the GOM Oil and Gas SID. Non-OCS oil- and gas-related activities, including noise, discharges and wastes, coastal land use/modification, offshore habitat modification/space use, bottom disturbance, strikes and collisions, and climate change, would also contribute to cumulative effects to marine mammals.

Noise: Over the last few decades, low-frequency ambient ocean noise has increased substantially due to a steady increase in shipping as vessels become more numerous and of larger tonnage (Hildebrand 2009; McKenna et al. 2012; National Research Council 2003a). In Mississippi Canyon and DeSoto Canyon, primary sound sources recorded in frequencies between 10 Hz and 96 kHz were comprised of seismic surveys, shipping, storms, and marine mammal vocalizations (Amaral et al. 2022). Elevated ocean noise levels can interfere with communication (i.e., acoustic masking) (Clark et al. 2009; Erbe et al. 2016) and increase stress in marine mammals, which may lead to lower reproductive output and increased susceptibility to disease (Kight and Swaddle 2011). The biological significance of behavioral responses to underwater noise and the population consequences of those responses are not fully understood (National Research Council 2005; Southall et al. 2007; 2019; 2021b). Chapter 3.7.5.1 of BOEM's Biological Environmental Background Report (BOEM 2021b) and Chapter 4.3.6.2.1 of the GOM Oil and Gas SID contain additional information on potential cumulative noise impacts on marine mammals.

Discharges and Wastes: Discharges and wastes have the potential to modify suitable habitat for marine mammals (Morton 2003). Major sources in the OCS that can interact with marine mammals include derelict fishing gear and ghost nets. Marine debris affects marine habitats and marine life worldwide, primarily through entanglement or ingestion (e.g., choking) (Gall and Thompson 2015). Entanglement in marine debris can lead to injury, infection, reduced mobility, increased susceptibility to predation, decreased feeding ability, fitness consequences, and mortality of marine mammals (NMFS 2022c). Marine debris ingestion can lead to intestinal blockage, which could impact feeding ability and lead to injury or death. Harmful algal blooms, including brown and red tides, occur almost every year in GOM waters. These blooms could kill, displace, or cause respiratory or reproductive issues in marine mammals (Fire et al. 2008). Bottlenose dolphins and manatees are most at risk from nearshore discharges and wastes. Since other marine mammals are not commonly found in coastal waters, they are less likely to be impacted by nearshore pollution. Manatees are exposed to herbicides by ingesting aquatic vegetation containing concentrations of pollutants (O'Shea et al. 1984). The propensity of manatees to aggregate at industrial and municipal outfalls also may expose them to high concentrations of contaminants (Stavros et al. 2008). Microplastics and macroplastics have been shown to affect marine mammals directly and indirectly (Alava et al. 2023). Plastics have been found inside deceased marine mammals (Gregory 2009). Prey species also affect the influence of pollution, such as microplastics, on marine mammals. Biomagnification in fish results in the generally higher contaminant levels in fish-eating marine mammals (Gray 2002). Chapters 3.7.5.2 and 3.7.5.3 of BOEM's Biological Environmental Background Report (BOEM 2021b) and Chapter 4.3.6.2.1 of the GOM Oil and Gas SID (BOEM 2023e) contain additional information on potential cumulative impacts from discharges and wastes on marine mammals.

Coastal Land Use/Modification: An increase in built infrastructure may affect habitat utilized by coastal marine mammals (e.g., coastal dolphins and manatees). Coastal construction can degrade or destroy coastal habitats and degrade water quality by increased sedimentation and pollutant runoff, affecting coastal marine mammals if ingested. For example, dolphins have been shown to stop feeding though continue socializing in habitat degraded by coastal bridge construction (Weaver 2021).

Offshore Habitat Modification/Space Use: Physical features, including canyons, used by marine mammals could be degraded indirectly by various anthropogenic activities. Anthropogenic events can cause the loss of core and/or preferred habitat if habitat becomes unsuitable (Morton 2003). In addition, active fishing line and gear, which is managed by NMFS, can pose entanglement and ingestion risks to marine mammals (Jog et al. 2022; Wells et al. 1998). Entanglement can decrease the individual's swimming ability, disrupt feeding, cause life-threatening injuries, or result in death. Fisheries bycatch of marine mammals has also occurred in the GOM, such as from pelagic longline fisheries and shrimp trawl fisheries (NMFS 2016).

Bottom Disturbance: Various bottom-disturbing anthropogenic activities can degrade or destroy benthic features used by some marine mammals for foraging and/or habitat. Such activities can result in the loss of foraging grounds and/or preferred habitat. For example, anchors and trawling disturb the seafloor and sediments in the area where they are dropped or emplaced. Further, anchoring can cause physical crushing and compaction beneath the anchor and chains or lines.

Strikes and Collisions: Vessel strikes from non-OCS oil- and gas-related activities are known to cause injuries and fatalities for several large whale species (Constantine et al. 2015; Crum et al. 2019; Laist et al. 2001). Vessel speed and size influence the strike risk. Deep-diving whales (e.g., sperm whale) may be more vulnerable to vessel strikes given the longer surface period required to recover from extended deep dives (Laist et al. 2001). The Rice's whales spend 90 percent of their time within 39 ft (12 m) of the ocean's surface (Constantine et al. 2015), which could make them vulnerable to strikes by large ships. Manatees are slow-moving and are often struck by smaller boats (FWS 2001). Chapter 3.7.5.4 of BOEM's Biological Environmental Background Report (BOEM 2021b) and Chapter 4.3.6.2.1 of the GOM Oil and Gas SID contain additional information on potential cumulative impacts of strikes and collisions on marine mammals.

Climate Change: Climate change can influence or act synergistically with other IPFs on marine mammals, depending on the geographic location and season. Several uncertainties exist on how climate change impacts marine mammals (Evans and Bjørge 2013; Silber et al. 2017), though it is assumed that range shifts (e.g., in response to shifting prey distribution or expansion of breeding grounds), timing of important biological activities (e.g., breeding), and regional abundance changes could occur (Learmonth et al. 2006). Warming waters can affect the timing of annual events such as plankton blooms (important food source for baleen whales [e.g., Rice's whale]), migration, and reproduction in some species, potentially disrupting predator-prey relationships, with cascading effects throughout the food web (Ullah et al. 2018). There is also research suggesting that ocean acidification from rising carbon dioxide levels could potentially decrease sound absorption in oceans, thereby causing amplified levels of ambient noise (Gazioğlu et al. 2015). Further, increased sea-surface temperatures likely enhance the magnitude and frequency of harmful algal blooms and their associated toxins (O'Neil et al. 2012). While some effects are anticipated, the precise impacts of global climate change on the GOM cannot currently be predicted or parsed out from every global activity.

A single proposed OCS oil and gas lease sale, regardless of alternative, would represent only a small portion of activity when compared to the existing OCS Oil and Gas Program in the GOM (**Table 3.3-2**). In the context of past, present, and reasonably foreseeable OCS and non-OCS oil- and gas-related activities within the area of analysis, the *incremental contribution* of a proposed OCS oil and gas lease sale to cumulative impacts on marine mammals would be **negligible** when properly regulated and mitigated. Based on the analysis above, an OCS oil and gas lease sale would not be expected to result in, or have a notable or measurable contribution to, any new or ongoing significant cumulative impacts not already being experienced by most marine mammals in the area of analysis. However, for the small, vulnerable population of Rice's whale in the GOM, the additional vessel trips associated with the proposed action may pose a small, potentially significant contribution to cumulative impacts of vessel strike to the Rice's whale. Given the sheer number of vessels projected to transit throughout the Action Area during the period of analysis, the incremental increase in risk is quite small but should be acknowledged. Required mitigating measures significantly reduce the potential for strike, but should one accidental strike occur, the impact could have population-level impacts for Rice's whale.

4.17.9 Sea Turtles

Cumulative impacts to sea turtles could result from noise, offshore habitat modification/space use, bottom disturbance, lighting and visual impacts, unintended releases into the environment, response activities, and strikes and collisions associated with ongoing activities from previous OCS oil and gas lease sale activities (**Table 3.3-2**), as summarized above in **Chapter 4.9.2** and in greater detail in Chapter 4.3.7 of the GOM Oil and Gas SID. Similar to the IPFs identified for routine OCS oil- and gas-related activities, non-OCS oil- and gas-related activities could also influence sea turtles in the GOM. These activities are also grouped into seven IPF categories: noise; discharges and wastes; coastal land use/modification; lighting and visual impacts; offshore habitat modification/space use (including fisheries interactions); bottom disturbance, and strikes and collisions. The content under each IPF heading below summarizes the more relevant detailed discussion of how non-OCS oil- and gas-related activities can affect sea turtles found in Chapter 4.3.7.1.2 of the GOM Oil and Gas SID.

Noise: Over the last few decades, low-frequency ambient ocean noise has increased substantially due to a steady increase in shipping as vessels have become more numerous and of larger tonnage (Haver et al. 2021; Hildebrand 2009; McKenna et al. 2012). Vessel traffic is recognized as a major contributor to anthropogenic ocean noise, primarily in the low-frequency bands between 5 and 500 Hz. Elevated ocean noise levels could increase stress in sea turtles, which in turn could lower reproductive output and increase susceptibility to disease (Kight and Swaddle 2011). The impacts of increasing ambient noise are expected to be behavioral responses and possibly masking effects. Potential masking noises could fall within at least 50-1,000 Hz. However, there are no quantitative data demonstrating masking effects for sea turtles. State-based seismic surveys may also impact sea turtles and cause avoidance or injury. Chapter 3.6.6.1 of BOEM's Biological Environmental Background Report (BOEM 2021b) and Chapter 4.3.7.2.1 of the GOM Oil and Gas SID contain additional information on potential cumulative noise impacts on sea turtles.

Discharges and Wastes: Marine debris poses a threat to sea turtles through ingestion, entanglement, and habitat degradation. In the U.S., approximately 80 percent of marine debris wases into the oceans from land-based sources and 20 percent is from ocean sources (USEPA 2017). Point and nonpoint discharges of metals and organic compounds can degrade water quality. Debris in the form of trash and plastics can be ingested by sea turtles (Choi et al. 2021). Plastics have increasingly been found inside of deceased sea turtles (Gregory 2009; Schuyler et al. 2016). The ingestion of plastics and marine debris in general can lead to intestinal blockage, which could impact feeding and which may ultimately lead to injury or death. Recent studies have identified the potential for microplastics to cause, in addition to physical impacts, metabolic and toxicity impacts on variety of marine organisms (Parolini et al. 2023). The presence of microplastics on nesting beaches may affect sea turtle nesting site by altering the properties of sediment that affect temperature and permeability (Estrella-Jordon et al. 2023). Sea turtles may also become entangled in marine debris, which can lead to injury, infection, fitness consequences, and mortality. Chapter 4.3.7.2.1 of the GOM Oil and Gas SID contains additional information on potential cumulative impacts from discharges and wastes on sea turtles.

Coastal Land Use/Modification: Sea turtle habitats may be degraded or destroyed by coastal development activities such as beach reclamation, beach renourishment, and dredging activities (Kildow et al. 2016; Sengupta et al. 2018; Shamblott et al. 2021). Increasing infrastructure is likely to affect sea turtle nesting habitat. Coastal construction that disrupts the process of egg-laying can impact sea turtles due to how long it takes to reach sexual maturity (Harewood and Horrocks 2008). Additionally, this construction may change the composition and composure of the beach, which can impact sea turtles. Coastal construction may also indirectly degrade water quality by increased sedimentation, pollutant runoff, and potential discharges from construction vehicles.

Lighting and Visual Impacts: Increasing coastal development, including artificial lighting from beachfront properties and other buildings, could threaten nesting success and hatchling survival

(Harewood and Horrocks 2008; Silva et al. 2017). Beachfront lighting has the potential to attract and disorient hatchlings when they emerge from the nest, leading them away from the water and towards roads and buildings where they may die from exposure, predators, or vehicles, or become trapped by obstacles.

Offshore Habitat Modification/Space Use: Offshore habitat modification could degrade sea turtle habitats via pollution and/or bottom or land disturbance. Pollution has the potential to modify suitable habitat for sea turtles (Morton 2003). Bottom disturbance could also destroy submerged aquatic vegetation habitat that sea turtles depend on for feeding and breeding although likely temporary. Habitat degradation could persist and have long-term residual impacts on community structure and habitat function (Morton 2003).

Commercial fishing operations, such as shrimp trawl fisheries, often use equipment that may threaten sea turtles through entanglement or ingestion (Valverde and Holzwart 2017). Similar to commercial fishing, recreational fishing also results in increased marine traffic and resource consumption. Fishing line and gear that is not disposed of properly can create hazards to sea turtles and are outside BOEM/BSEE's regulatory authority. Sea turtle bycatch occurs in the GOM, especially for the longline fishery, and can be driven by turtle density, fishing intensity, or both (Lewison et al. 2014). Turtles may be accidentally caught and killed in finfish trawls, seines, gill nets, weirs, traps, longlines, and driftnets (Brady and Boreman 1993; Epperly et al. 2007; Jenkins 2012).

To reduce fishery impacts to sea turtles, NMFS has required the use of turtle excluder devices in southeast U.S. shrimp trawls since 1989 and has increased efforts over the years for adequate protection to decrease the number of entrapments/entanglements. Since implementing the required use of turtle excluder devices throughout the shrimp fishing industry, gear improvements continue to be introduced nearly annually. Florida and Texas have banned all but very small nets in State waters. Louisiana, Mississippi, and Alabama have also placed restrictions on gillnet fisheries within State waters, such that minimal commercial gillnetting takes place in southeast waters. Mortality rates have decreased since the implementation of these regulations but because turtles mature slowly, populations are still recovering (Jenkins 2012; Valverde and Holzwart 2017). Chapter 3.6.6.3 of BOEM's Biological Environmental Background Report contains additional information.

Bottom Disturbance: Green, Kemp's ridley, and loggerhead turtles use soft bottom benthic habitats for foraging. Hawksbill turtles feed in coral and hard bottom areas, which are generally avoided. Various bottom-disturbing anthropogenic activities can degrade or destroy benthic features used by some sea turtles for foraging and/or habitat. Such activities can result in the loss of foraging grounds and/or preferred habitat. For example, anchors and trawling disturb the seafloor and sediments in the area where they are dropped or emplaced. Further, anchoring can cause physical crushing and compaction beneath the anchor and chains or lines. State-regulated infrastructure emplacement, pipeline trenching, and structure removal would be localized and temporary, and habitat loss is not expected. It is assumed that careful timing of activities and siting of onshore and State-regulated infrastructure, particularly with regard to ESA-listed species, would be applied.

Strikes and Collisions: Vessel traffic in the GOM primarily occurs near major ports, such as Port Fourchon, Louisiana, and Houston, Texas. Vessel strikes are a poorly studied threat to sea turtles, though they are known to result in injury and mortality (Work et al. 2010). Several species, such as loggerheads, are known to bask at the surface for long periods. Although sea turtles can move somewhat rapidly, they are still vulnerable to strikes from vessels that are moving at more than 4 km/hr (2.5 mph), which is common in open water (Hazel et al. 2007; Work et al. 2010). Both live and dead sea turtles are often found with deep cuts and fractures indicative of collision with a boat hull or propeller (Hazel et al. 2007). Chapter 3.6.6.4 of BOEM’s Biological Environmental Background Report contains additional information.

There are limited data available concerning potential sea turtle impacts from vessel strikes due to a lack of studies and/or the challenges with detecting such impacts (Nelms et al. 2016). Nonetheless, strikes from all types of vessels are known to result in sea turtle injury and mortality in the GOM (Lutcavage et al. 1997; Nelms et al. 2016; Work et al. 2010). Sea turtles occur in all GOM planning areas and are vulnerable to vessel strikes due to the time they spend at the surface. Recent studies show that the time spent at the surface for basking, feeding, orientation, and mating is approximately 11 percent for loggerheads (Garrison et al. 2020), approximately 19 percent for greens (Roberts et al. 2022), and between 11 and 23 percent (Garrison et al. 2020) for Kemp’s ridleys, depending on the season. If a sea turtle is struck by a vessel, serious injury, and/or minor, non-lethal injury can occur, with the associated effects varying based on the size and speed of the vessel.

Climate Change: Other cumulative factors not already discussed as part of existing conditions but which are reasonably foreseeable and could contribute to cumulative impacts to sea turtles include climate change and disease. Sea-level rise associated with climate change will decrease the physical extent of the nesting beach and may decrease nesting suitability (Martins et al. 2022). Projected sea-level rise and storm surge activity pose major threats to nesting habitat and reproductive success (Lyons et al. 2020). Hatchling sex is determined by temperature during embryonic development, with warmer nests usually producing more females (Gatto et al. 2021; Hays et al. 2014; Laloë et al. 2014). Therefore, warmer nests could produce more females and potentially bias sex ratios that ultimately may have populations level impacts (Gatto et al. 2021; Hays et al. 2023; Laloë et al. 2014; Lockley and Eizaguirre 2021). The continued increase in temperature is also linked to hatchling mortality. As incubation temperatures reach the upper thermal tolerance limit, temperature-linked mortality also increases (Lyons et al. 2022). Synthesis and modeling studies utilizing regional (Catron et al. 2023) and worldwide (Hays et al. 2023) nesting data and projected global temperature information project population decreases through different mechanisms. However, competition for mates tends to balance operational sex ratios (Jennions and Fromhage 2017). Therefore, relying solely on sex ratios based on nest incubation temperature may not be the most reliable method for assessing the over-feminization of a population or the impact of climate change on the sea turtle population long term (Santidrián Tomillo 2022). Additionally, factors surrounding key demographic parameters (e.g., male breeding rates and sex-specific survival) need further investigation to properly project the impacts of global warming on the sea turtle population (Maurer 2021). Additional information regarding sea turtles can be found in Chapter 3.6 of BOEM’s Biological Environmental Background Report and Chapter 4.3.7 of the GOM Oil and Gas SID.

Natural Processes: Sea turtles are affected by disease, including species-specific fibropapillomatosis; viral, bacterial, and mycotic (fungal) infections; parasites (internal or external); and other environmental health problems (e.g., hypothermic stunning) (Herbst 1994; Van Houtan et al. 2014). Disease can cause physical impacts and disrupt swimming, feeding, and other life functions. Disease could impact sea turtle survival, reproductive fitness, and longevity. Population levels that impact disease are not well understood. Host-pathogen relationships are sensitive to environmental conditions, and it is suspected that climate change could increase the risk of disease (Burge et al. 2014).

A single proposed OCS oil and gas lease sale, regardless of alternative, would represent only a small portion of activity when compared to the existing OCS Oil and Gas Program in the GOM (**Table 3.3-2**). In the context of past, present, and reasonably foreseeable OCS and non-OCS oil- and gas-related activities within the area of analysis, the incremental contribution of a proposed OCS oil and gas lease sale to cumulative impacts on sea turtles would be **negligible** when properly regulated and mitigated. Based on the analysis above, an OCS oil and gas lease sale would not be expected to result in, or have a notable or measurable contribution to, any new or ongoing significant cumulative impacts not already being experienced by sea turtles in the area of analysis.

4.17.10 Commercial Fisheries

Cumulative impacts to commercial fisheries could result from bottom disturbance, noise, coastal land use/modification, lighting and visual impacts, offshore habitat modification/space use, socioeconomic changes and drivers, unintended releases into the environment, response activities, and strikes and collisions associated with previous OCS oil and gas lease sale activities, as summarized above in **Chapter 4.10.2** and in greater detail in Chapter 4.4.2 of the GOM Oil and Gas SID. Similar to the IPFs identified for routine oil- and gas-related activities, discharges and wastes, bottom disturbance, noise, coastal land use/modification, lighting and visual impacts, offshore habitat modification/space use, air emissions and pollution, and socioeconomic changes and drivers associated with non-OCS oil- and gas-related activities can also influence commercial fisheries in the GOM. For a detailed discussion of how non-OCS oil- and gas-related activities can affect commercial fisheries, refer to Chapter 4.4.2 of the GOM Oil and Gas SID. Effects from these IPF categories would vary depending on their frequency, duration, and geographic extent as discussed below.

Air Emissions and Pollution: Commercial fisheries are dependent on the health of fish and invertebrate populations. Although air emissions from non-OCS oil- and gas-related activities is not expected to have population-level effects to fish and invertebrates (**Chapter 4.6**), localized effects to fish may occur. Air emissions resulting from non-OCS oil- and gas-related activities may have negative effects on coastal habitats, upon which many of these species depend. Air pollutants result from manmade and natural sources (e.g., vehicle emissions and wildfires) and contribute to increased CO_2, leading to ocean acidification, which can negatively affect fish and invertebrate resources' health and their habitat.

Discharges and Wastes: Discharges and wastes associated with non-OCS oil- and gas-related activities can indirectly affect commercial fisheries by negatively affecting fish and invertebrate populations. Potential effects of discharges and wastes to fish and invertebrate populations, upon which commercial fisheries depend, are discussed in **Chapter 4.6**. Decreases in water quality caused by the influx of freshwater from rivers carrying excess nutrients and chemicals related to agricultural and industrial uses inland and discharges of chemical waste products from non-point sources and accidental discharges can negatively affect the health and survival of non-mobile species (e.g., oysters). Because the success of commercial fisheries depends on the health of the target species, if these species are negatively affected by discharges and wastes, then commercial landings, revenues, and associated fisheries reliant economies can also be negatively affected.

Bottom Disturbance: Bottom disturbance related to non-OCS oil- and gas-related activities such as indiscriminate commercial fishing practices, offshore dredging and sand mining, placement of artificial reefs, and State oil and gas production can negatively or positively affect fish and invertebrates, thereby causing indirect effects to commercial fisheries landings. Indiscriminate commercial fishing practices (e.g., trawling and pots) can injure or kill many fish species caught as bycatch, such as juveniles of commercially important species, reducing fish populations and negatively affecting potential landings and revenues because the juvenile fish unintentionally caught would not be available for future harvesting. The potential effects of bottom disturbances to fish and invertebrates, upon which commercial fisheries depend, are discussed in **Chapter 4.6**.

Noise: While noise from non-OCS oil- and gas-related activities is not expected to have population-level effects on fish and invertebrates (**Chapter 4.6**), anthropogenic sound caused by non-OCS oil- and gas-related activities may negatively affect commercial fisheries. When anthropogenic sound impacts fish and invertebrates, it indirectly influences commercial fisheries. Displacement, physical harm, or fatalities to fish and invertebrates due to anthropogenic sound can result in decreased fishing landings and revenues, ultimately affecting jobs and incomes throughout the commercial fisheries supply chain.

Coastal Land Use/Modification: Although coastal land use from non-OCS oil- and gas-related activities is not expected to have population-level effects to fish and invertebrates (**Chapter 4.6**), localized effects to fish may occur. Coastal developments such as industrial and residential construction near harbors, waterways, and beachfronts can negatively affect fish and invertebrate species important to commercial fisheries by modifying or degrading coastal vegetation and submerged aquatic vegetation habitats, such as salt marsh grasses, crucial to various life stages of commercially important fish species.

Lighting and Visual Impacts: Non-OCS oil- and gas-related activities can produce artificial lighting from public and private docks and piers and industry-related infrastructure that can interfere with natural predator-prey interactions, causing negative effects to fish and invertebrates, and consequently affecting commercial fisheries. Although lighting from non-OCS oil- and gas-related activities is not expected to have population-level effects to fish and invertebrates (**Chapter 4.6**), localized effects to fish and invertebrates may also result in negative effects to commercial fisheries by potentially decreased landings.

Offshore Habitat Modification/Space Use: Although space-use conflicts from non-OCS oil- and gas-related activities are not expected to have population-level effects to fish and invertebrates (refer to Chapter 4.3.4 of the GOM Oil and Gas SID), localized effects to fish may occur. Commercial fishermen may encounter space-use conflicts with non-OCS oil- and gas-related activities in State waters and recreational, commercial, and military vessels that temporarily restrict access to fishing areas. Vessel space-use conflicts may particularly occur near major ports and in shipping lanes as vessels transit to and from shore. There is a large amount of vessel traffic in the GOM, particularly near major ports. Offshore habitat modification caused by non-OCS oil- and gas-related oil and gas structure emplacement in State waters can cause positive effects to commercial fisheries by providing habitat for fish populations for a period of years until the structures are decommissioned, which may have negative or positive effects depending on the nature of the decommissioning.

Socioeconomic Changes and Drivers: This explores how commercial fisheries in the GOM are affected by various economic and management factors. Some of these factors are related to non-OCS oil- and gas-related activities, such as competing with other markets, the demand for GOM seafood, and the overall state of the economy. Other factors are related to fisheries management strategies, such as limiting the fishing season, size, and number of fish to conserve the species. These factors can have positive or negative impacts on commercial fisheries depending on the situation. For example, economic fluctuations influence consumer spending and seafood consumption. During economic downturns, people may cut back on purchasing seafood, affecting the market and ultimately commercial fishers. Furthermore, if the demand for GOM seafood increases due to factors like tourism or culinary trends, it can be beneficial for commercial fisheries. However, if demand declines, it may lead to lower prices for seafood products, impacting fishers' income.

Climate Change: Rising sea temperatures, ocean acidification, and changes in water currents are some of the key consequences of climate change that directly impact commercial fisheries in the offshore GOM. Warmer waters alter the distribution and abundance of fish species, leading to a shift in the ecosystem's dynamics. For instance, studies (Coleman and Koenig 2010) indicate that certain commercially valuable species, such as red snapper and grouper, are moving towards deeper and cooler waters in search of suitable habitats. This migration not only affects the availability of these species for fishing activities but also disrupts the delicate balance of the food web, potentially impacting other species within the ecosystem. Furthermore, climate change-induced ocean acidification (Osborne et al. 2022) poses a threat to the offshore GOM's commercial fisheries. This acidification negatively impacts shell-forming organisms, such as oysters and clams, which are crucial components of the GOM's commercial fisheries. Research suggests that reduced shell growth and increased mortality rates among these species can disrupt the entire fishery ecosystem, affecting both the economic viability and sustainability of the industry. The location and size of coastal hypoxic zones (which are likely exacerbated by temperature and ocean acidification) can also affect the spatial dynamics of fisheries, such as the GOM shrimp fishery, with potential economic repercussions (Purcell et al. 2017).

Future alterations of the physical ocean and coastal environment, as predicted with climate change, are expected to have significant impacts on GOM fisheries (NMFS 2019). There is now a national strategy for integrating climate information into fishery decisionmaking (Busch et al. 2016), and NOAA and the Gulf of Mexico Fishery Management Council are now directly incorporating ocean conditions and climate projections in their regional planning and decisionmaking (NMFS 2019). For example, amendments to the Fishery Management Plan for the Coastal Migratory Pelagic Resources of the Gulf of Mexico and Atlantic Region have considered how environmental influences have changed migratory patterns over time. For further descriptions of the cause-and-effect relationships between these IPFs and fishes and invertebrates, refer to **Chapter 4.6** of this programmatic EIS and Chapter 4.3.4 of the GOM Oil and Gas SID.

A single proposed OCS oil and gas lease sale, regardless of alternative, would represent only a small portion of activity when compared to the existing OCS Oil and Gas Program in the GOM (**Table 3.3-2**). In the context of past, present, and reasonably foreseeable OCS and non-OCS oil- and gas-related activities within the area of analysis, the *incremental contribution* of a proposed GOM oil and gas lease sale to cumulative impacts on commercial fisheries would be **negligible** to **minor adverse** when properly regulated and mitigated (refer to **Table 4.10-4** and Alternative B for a description of mitigating measures). Based on the analysis above, an OCS oil and gas lease sale would not be expected to result in, or have a notable or measurable contribution to, any new or ongoing significant cumulative impacts not already being experienced by commercial fisheries in the area of analysis.

4.17.11 Recreational Fishing

Cumulative impacts to recreational fishing could result from bottom disturbance, coastal land use/modification, noise, lighting and visual impacts, offshore habitat modification/space use, socioeconomic changes and drivers, unintended releases into the environment, response activities, and strikes and collisions associated with previous OCS oil and gas lease sales, as summarized above in **Chapters 4.11.2.1 and 4.11.2.2** of this Programmatic EIS and in greater detail in Chapter 4.4.3 of the GOM Oil and Gas SID. In this scenario, cumulative impacts from ongoing OCS oil- and gas-related activities to recreational fishing would still occur and range from **beneficial (moderate)** to **moderate adverse**. The overall number of production structures also serves more of a beneficial role for reef fishing, although the corresponding decommissioning of these structures negatively impacts recreational fishing. However, as discussed above, most recreational fishing in the Gulf of Mexico occurs close to shore. The actual impacts would depend on the locations of activities, species affected, intensity of recreational fishing activity in the affected area, and substitutability of any lost fishing access.

Similar to the IPFs identified for routine oil- and gas-related activities, non-OCS oil- and gas-related activities also influence recreational fishing in the GOM through air emissions and pollution; discharges and wastes; bottom disturbance; coastal land use/modification; noise; lighting and visual impacts; offshore habitat modification/space use; and socioeconomic changes and drivers.

For a detailed discussion of how non-OCS oil- and gas-related activities can affect recreational fishing, refer to Chapter 4.4.3 of the GOM Oil and Gas SID.

Air Emissions and Pollution: Recreational fishing depends on the health of fish and invertebrate populations. Although air emissions and pollution from non-OCS oil- and gas-related activities is not expected to have population-level effects to fish and invertebrates (**Chapter 4.6** of this Programmatic EIS and Chapter 4.3.4 of the GOM Oil and Gas SID), localized effects to fish may occur. Air emissions resulting from non-OCS oil- and gas-related activities may have negative effects on coastal habitats upon which many of these species depend. Air pollutants result from manmade and natural sources (e.g., vehicle emissions and wildfires) and contribute to increased CO_2, leading to ocean acidification, which can negatively affect fish and invertebrate resources' health and their habitat. To the extent that air emissions can negatively affect coastal habitats and fish and invertebrates, recreational fishing can also experience negative effects in terms of reduced aesthetic enjoyment and catches.

***Discharges and Wastes*:** Discharges and wastes associated with non-OCS oil- and gas-related activities can indirectly and negatively affect recreational fishing by negatively affecting fish and invertebrate populations. For example, decreases in water quality caused by the influx of freshwater from rivers carrying excess nutrients and chemicals related to agricultural and industrial uses inland and discharges of chemical waste products from non-point sources and accidental discharges can expand the size of the hypoxia zone in the GOM, which can cause pelagic species of recreational interest to re-locate. The movement of the fish can interfere with recreational fishers' access to desired species by extending the distance to reach fishing grounds, increasing fuel costs, and interfering with the aesthetic enjoyment of the activity. Accidental oil spills in State waters from State oil and gas activities could affect recreational fishing by polluting the waters, harming or killing target fish, closing areas to fishing, and negatively affecting the aesthetic fishing experience. In addition, these negative effects could also potentially lead to less demand for charter fishing and a negative ripple effect through the economic supply chain.

Bottom Disturbance: Bottom disturbances related to non-OCS oil- and gas-related activities can negatively affect fish and invertebrate resources, thereby causing indirect effects to recreational fishing. Indiscriminate commercial fishing practices (e.g., trawling and pots) can injure or kill many fish species caught as bycatch, reducing the potential for recreational fishers to catch these fish. Sediment dredging and disposal, sand mining, anchoring, and offshore marine transportation disturb sediments and increase turbidity, resulting in negative effects to fish and invertebrates. Benthic prey, juvenile fishes, eggs, and larvae can all be smothered from turbidity causing harm or death, negatively affecting recreational fishing by decreasing the availability of important fish and invertebrates. Emplacement and decommissioning activities related production structures could negatively affect fish populations in the area by generating turbidity, removing habitats, and fish mortality if explosives are used. These negative effects would be localized and short-term because turbidity subsides, surviving fish move to other habitats, and fish populations are expected to recover from localized fish mortality. The biological consequences of these changes are further discussed in **Chapters 4.3 and 4.6** of this Programmatic EIS and in greater detail in Chapters 4.3.1 and 4.3.4 of the GOM Oil and Gas SID and

Chapters 4.4 and 4.5 of the Biological Environmental Background Report. To the extent that fish and invertebrates are affected by bottom disturbances, there could be negative effects on the economic supply chain for recreational fishing through reduced private or charter fishing trips and reduced purchases of durable equipment.

Noise: Although noise from non-OCS oil- and gas-related activities is not expected to have population-level effects to fish and invertebrates (refer to **Chapter 4.6** of this Programmatic EIS and Chapter 4.3.4 the GOM Oil and Gas SID), anthropogenic sound caused by non-OCS oil- and gas-related activities may negatively affect recreational fishing. Examples of non-OCS oil- and gas-related activities that can produce underwater noise include recreational boating activities, commercial fishing vessels, cruise ships, cargo vessels, military activities, dredging operations, and in-water construction. To the extent that anthropogenic sound caused by non-OCS oil- and gas-related activities can negatively affect fish populations, it can indirectly affect recreational fishing. Noise may directly affect recreational fishing to the extent that it may reduce the aesthetic enjoyment of the activity.

Coastal Land Use/Modification: Although coastal land use from non-OCS oil- and gas-related activities is not expected to have population-level effects to fish and invertebrates (refer to **Chapter 4.6** of this Programmatic EIS and Chapter 4.3.4 of the GOM Oil and Gas SID), localized effects to fish may occur. Coastal land disturbances caused by non-OCS oil- and gas-related activities (e.g., coastal developments such as industrial and residential construction near harbors, waterways, and beachfronts) can negatively affect fish and invertebrate species important to recreational fishing by modifying or degrading coastal vegetation and submerged aquatic vegetation habitats such as salt marsh grasses crucial to various life stages of recreationally important fish species or reduce access to preferred fishing areas and infrastructure (e.g., boat launches). Non-OCS oil- and gas-related coastal land-disturbing activities may negatively affect recreational fishing to the extent that reduced catch or the activity itself interferes with recreational fishers' aesthetic enjoyment and potentially decrease demand for charter services. These negative effects would be localized in nature and temporally limited in the case of construction activities. Conversely, recreational fishing can be positively affected by coastal land disturbances if they involve improvements to existing coastal infrastructure or development of new support infrastructure, such as hotels and restaurants, that would attract economic inputs from recreational fishers. In addition, construction of piers and boat launches can positively affect recreational fishing by increasing fishing opportunity.

Coastal land use for risk protection and mitigation can also affect recreational fishing. For example, in September 2019, a Federal disaster declaration was issued for Louisiana, Mississippi, and Alabama when oyster and coastal shrimp fisheries were severely impacted by freshwater flooding into Mississippi Sound as a result of freshwater flow from the Bonnet Carré Spillway in 2019 (DOC 2019). The Spillway was opened multiple times from 2016 to 2020 to relieve pressure on Mississippi River levees, causing negative impacts to coastal fisheries (Byrd 2019). The economic impacts to recreational fishing for the 2016-2020 time period are not yet clear; however, Posadas and Posadas Jr. (2017) studied the impact of the 2011 Bonnet Carré Spillway opening and estimated that the

Mississippi oyster fishery suffered foregone landing values ranging from $21.8 to $46.0 million, lost 145-324 jobs per year from 2011 to 2013, and lost labor income estimated at $1.8-$8 million per year.

Lighting and Visual Impacts: Non-OCS oil- and gas-related activities can produce artificial lighting from public and private docks and piers and industry-related infrastructure that can interfere with natural predator-prey interactions and larval settlement site selection, potentially causing negative effects to fish and invertebrates. Although lighting from non-OCS oil- and gas-related activities is not expected to have population-level effects to fish and invertebrates (refer to **Chapter 4.6** of this Programmatic EIS and Chapter 4.3.4 of the GOM Oil and Gas SID), localized effects to fish may occur. Conversely, artificial lighting can also cause positive effects for recreational fishing because many recreational fishers enjoy night fishing at public and private docks where the lights attract fish to be caught, as well as provide safety for fishing at night.

Offshore Habitat Modification/Space Use: Although space-use conflicts from non-OCS oil- and gas-related activities are not expected to have population-level effects to fish and invertebrates (refer to **Chapter 4.6** of this Programmatic EIS and Chapter 4.3.4 of the GOM Oil and Gas SID), localized effects to fish may occur. Recreational fishing may encounter negative space-use conflicts with non-OCS oil- and gas-related activities in State waters, as well as recreational and military vessels that temporarily restrict access to fishing areas. Vessel space-use conflicts may particularly occur near major ports and in shipping lanes as vessels transit to and from shore. In many instances throughout the GOM, competition between commercial and recreational fishermen targeting the same species led to depleted fish stocks and habitat alterations, reducing overall landings. Offshore habitat modification/space use from the installation of production structures related to State oil and gas activities as well as artificial reef placement could enhance reef fish habitat and thus improve recreational fishing opportunities by congregating some fish and invertebrates near the structures. Accessible fishing structures can lead to an increase in recreational fishing trips with a positive ripple effect through the economic supply chain until the structures are decommissioned, which may have negative or positive effects depending on the nature of the decommissioning (e.g., rigs may be decommissioned through BSEE's Rigs-to-Reefs program and be moved closer to shore and thus be more easily accessed by recreational fishers).

Socioeconomic Changes and Drivers: Various socioeconomic changes and drivers associated with non-OCS oil- and gas-related activities also may affect recreational fishing. Changes in commodity prices can negatively affect fuel costs for fishers who are likely to alter their behavior due to this economic disincentive. During times of economic hardship, the levels of recreational fishing are likely to decrease, causing supply chain effects related to decreased demand for services depending on the recreational fishing sector. Conversely, when economies are flourishing with high gross domestic product and low unemployment, recreational fishing activity would increase, positively feeding back into the economy. Recreational fishing would also be positively correlated with general trends in tourism and the overall economy.

Recreational fishing activity is also heavily influenced by regulations and competition between commercial and recreational fishermen targeting the same species. National concern for the health and sustainability of marine fisheries has led to the development of fishery management plans, which affect recreational fish species in the GOM. Fisheries management plans focused on targeted species, such as red snapper, have led to size and creel limits as well as seasonal closures and gear restrictions or modifications in both commercial and recreational fishing. The Magnuson-Stevens Fishery Conservation and Management Act requires that fishery management plans also identify essential fish habitat to allow it to be protected from fishing, other coastal and marine activities, and developments.

Climate Change: Other cumulative factors not already discussed as part of existing conditions but which are reasonably foreseeable and could contribute to cumulative impacts to recreational fishing include interrelated factors of climate change, weather events, land loss, and coastal protection and restoration measures. Additionally future renewable energy development activities could also impact recreational fishing.

Climate change is expected to have profound effects on marine ecosystems worldwide. Range expansions of tropical fishes may continue to occur and have the potential to alter the ecology of existing ecosystems, including food web and habitat interactions (Fodrie et al. 2010; Fujiwara et al. 2019; Purtlebaugh et al. 2020). Warming waters may continue to result in land loss and sea-level rise, altering habitat in coastal areas that many fishes and invertebrates utilize during some or all of their lives. The expected impacts to fishes and invertebrates, including those targeted by recreational fishers, from climate change over the 40-year span of a proposed action would be regional in scale, potentially altering distributions of fishes and invertebrates from warming waters and negatively affecting the habitat quality and extent through land loss and sea-level rise for traditionally targeted species (although different species might find these altered habitats attractive). For further descriptions of the cause-and-effect relationships between these IPFs and fishes and invertebrates, refer to Chapter 4.3.4 of the GOM Oil and Gas SID. Global climate change could then impact recreational fishing through multiple (and potentially unexpected) ways to the extent that it affects species targeted and habitats utilized by recreational fishers.

Natural Processes: The Gulf Coast of Texas, Louisiana, Mississippi, Alabama, and Florida have experienced multiple hurricanes in recent years: Hanna, Laura, Sally, Delta, and Zeta (2020); Ida and Nicholas (2021); Ian and Nicole (2022); and Idalia (2023). Of these, Category 4 Hurricanes Laura (with Delta following), Ida, Ian, and Idalia were particularly devastating, prompting multi-year recoveries often spanning multiple states. Hurricanes can directly impact businesses and infrastructure related to recreational fishing, such as boat ramps and fishing piers. They can also directly destroy or damage boats used in recreational fishing. Hurricanes can also cause large impacts to regional economies, which could in turn impact recreational fishing. Refer to **Chapter 3.6.12** of this Programmatic EIS and Chapter 3.3.1 of the GOM Oil and Gas SID for more information on major storms affecting the Gulf Coast.

Other Cumulative Factors: Coastal land loss, especially prominent in Louisiana, can negatively affect recreational fishing areas. Land loss could impact infrastructure used in recreational fishing, such as fishing piers or boat launches. It could also impact the environment, converting marsh areas into open water and increasing salinity levels, impacting which fish species are available to recreational fishers. Human population movement from land loss could also impact businesses and communities of those involved in recreational fishing, either as a pastime or as a business, such as charter boat captains. Conversely, population movement away from coastal communities due to factors such as land loss allows the proliferation of recreational homes often associated recreational fishing, replacing permanent residents in those communities (Solet 2006). Refer to **Chapter 4.16** for more information on how land loss can impact social factors, which in turn could indirectly impact those engaged in recreational fishing in those communities. State and Federal plans to protect against, and restore areas from, land loss can both indirectly impact recreational fishing through protection infrastructure (which could incidentally protect recreational fishing infrastructure, such as through levee systems) and ecosystem restoration (which could provide additional recreational fishing areas), and it can directly impact recreational fishing when explicitly incorporating it in protection and restoration planning. An example of the latter includes the Pointe-aux-Chenes Wildlife Management Area – Island Road Fishing Piers, which was constructed by the Louisiana Coastal Protection and Restoration Authority in 2020 using BP settlement monies (LDWF 2024).

Activities related to site characterization assessments for renewable energy, including bottom disturbance from geotechnical surveys, biological sampling (e.g., bottom trawling), and buoy installation may negatively impact fishes and invertebrates through displacement, injury, mortality, behavioral changes, or changes to population or community dynamics. Noise from sources such as HRG survey equipment and vessel engines may also result in negative effects to fishes and invertebrates such as masking, behavioral changes, and injury. These impacts could indirectly affect recreational fishing, although they would be high localized and temporary in nature. Vessel activity related to site characterization activities could present a space-use conflict with recreational fishers, although, like with oil- and gas-related vessel space-use, recreational fishers should be able to easily avoid these activities. For more information on the anticipated effects of GOM renewable energy site assessment and characterization, refer to BOEM's *Commercial and Research Wind Lease and Grant Issuance and Site Assessment Activities on the Outer Continental Shelf of the Gulf of Mexico: Final Environmental Assessment* (BOEM 2023d).

A proposed OCS oil and gas lease sale, regardless of alternative, would represent only a small portion of activity when compared to the existing OCS Oil and Gas Program in the GOM (**Table 3.3-2**). In the context of past, present, and reasonably foreseeable OCS and non-OCS oil- and gas-related activities within the area of analysis, the *incremental contribution* of a proposed GOM lease sale to cumulative impacts on recreational fishing would be **minor beneficial** (due to fish attraction at platforms and the potential use of decommissioned platforms as rigs-to-reefs) to **minor adverse** incremental impacts (due to impacts to fish populations, space-use conflicts, and oil spills) on recreational fishing activities because of the limited amount of activity and because the positive and negative impacts would partially offset each other. The actual impacts would depend on the locations of activities, species affected, intensity of recreational fishing activity in the affected area, and substitutability of any lost fishing access. Based on the analysis above, an OCS oil and gas lease sale would not be expected to result in, or have a notable or measurable contribution to, any new or ongoing significant cumulative impacts not already being experienced by recreational fishing in the area of analysis.

4.17.12 Recreational Resources

Cumulative impacts to recreational resources could result from air emissions, bottom disturbance, coastal land use/modification, lighting and visual impacts, offshore habitat modification/space use, socioeconomic changes and drivers, unintentional releases into the environment, response activities, and strikes and collisions associated with ongoing activities from previous OCS oil and gas lease sales (**Table 3.3-2**) as summarized above in **Chapter 4.12.2.2** of this Programmatic EIS and in greater detail in Chapter 4.4.5 of the GOM Oil and Gas SID. Existing significant impacts may be prolonged by any activities associated with reasonably foreseeable OCS oil and gas lease sales, but additional impacts are not expected given the extensive and longstanding OCS Oil and Gas Program in the GOM. Similar to the IPFs identified for routine OCS oil- and gas-related activities, non-OCS oil- and gas-related activities also influence recreational resources in the GOM through the following IPF categories: air emissions and pollution; discharges and wastes; bottom disturbance; coastal land use/modification; lighting and visual impacts; offshore habitat modification/space use; socioeconomic changes and drivers; and climate change. These potential cumulative impacts to recreational resources are summarized below and discussed in greater detail in Chapter 4.4.5.2.1 of the GOM Oil and Gas SID.

Air Emissions and Pollution: Air emissions and pollution from non-OCS oil- and gas-related activities can affect visibility and aquatic and terrestrial resources. Chapter 2.1.2 of the GOM Oil and Gas SID estimates and discusses non-OCS oil- and gas-related activities air emissions. These emissions can negatively affect human health, degrade habitats of plant and animal species, impede visibility, contribute to ocean acidification, and impact climate.

Discharges and Wastes: Discharge and wastes from non-OCS oil- and gas-related activities can negatively affect recreation and tourism by detracting from the aesthetic values of coastal areas, particularly beaches. However, dredge material can be used to enhance tourism and recreational usage of areas by shoring up areas undergoing subsidence and improving previous land uses.

Bottom Disturbance: Bottom disturbances from non-OCS oil- and gas-related activities can cause both positive and negative effects on tourism and recreational resources. While the installation of artificial reefs may temporarily disturb the ocean floor and smother some marine life, the additional hard substrate provides additional habitat that often enhances opportunities for recreational fishers and divers.

Coastal Land Use/Modification: Coastal land use/modification from non-OCS oil- and gas-related activities, such as oil spills in State waters, have the potential to contribute to beach erosion, both due to contaminated sediment and the potential sediment losses during the cleanup process. Also, increased coastal infrastructure can negatively affect tourism and recreational resources by reducing land available for these activities and diminishing recreational experiences.

Lighting and Visual Impacts: Lighting and visual impacts from non-OCS oil- and gas-related activities may be subjective depending on the location of the object, its lighting, and people in question. For example, platform lighting can detract from some nature experiences, but it can also improve visibility near the structure and add contrast to the landscape.

Offshore Habitat Modification/Space Use: Offshore habitat modification/space use from non-OCS oil- and gas-related activities, such as sand borrowing for beach nourishment projects, may temporarily conflict with recreational activities. Other activities can cause permanent space-use conflicts for recreational boating and water activities in those areas.

Socioeconomic Changes and Drivers: Socioeconomic changes and drivers from non-OCS oil- and gas-related activities can have several positive and negative effects on tourism and recreation. There may be pressures to develop industrial areas in existing natural or recreational areas. However, development may also encourage the expansion of other recreational resources, such as hotels and restaurants, to accommodate increased tourism and/or recreational activities.

Climate Change: By affecting the natural environment on which recreational resources are based, climate change could indirectly impact recreational resources in multiple ways. Sea-level rise, increasing temperatures, ocean acidification, coastal erosion/subsidence, more numerous or stronger tropical storms and hurricanes, and severe flooding events contribute to potential negative impacts to recreational resources exacerbated by climate change (Carter et al. 2018; Fleming et al. 2018). These impacts may result in permanent flooding or isolating of coastal habitat, rendering it unsuitable for recreational use. Coastal marshes and bays along the Gulf Coast that are havens for recreational activities (e.g., fishing, hunting, swimming, water sports, wildlife viewing, etc.) are facing substantial impacts that could be worsened by climate change. For example, the estuary of Galveston Bay, Texas, is at great risk from sea-level rise and subsidence, having lost over 35,000 acres of critical marsh habitat over the last 7 decades and experiencing a 27-inch sea-level rise in 120 years (Bertrand 2022). Climate change can negatively impact recreational resources by altering the natural conditions for recreation and damaging recreational infrastructure through sea-level rise, land loss, more severe flooding and storms, among other factors that challenge natural resource managers to develop targeted actions for handling climate change related issues (O'Toole et al. 2019). Coral reefs in the GOM, which are very popular for recreational diving, have been and would likely continue to be negatively impacted by rising temperatures and ocean acidification, ultimately negatively impacting the recreational and tourism sectors of the regional economy through reduced trips or visits (Lawman et al. 2022).

A single proposed OCS oil and gas lease sale, regardless of alternative, would represent only a small portion of activity when compared to the existing OCS Oil and Gas Program in the GOM (**Table 3.3-2**). In the context of past, present, and reasonably foreseeable OCS and non-OCS oil- and gas-related activities within the area of analysis described above, the *incremental contribution* of a proposed GOM oil and gas lease sale to cumulative impacts on recreational resources would be **negligible adverse**. Based on the analysis above, an OCS oil and gas lease sale would not be expected to result in, or have a notable or measurable contribution to, any new or ongoing significant cumulative impacts not already being experienced by recreational resources in the area of analysis.

4.17.13 Cultural, Historical, and Archaeological Resources

Cumulative impacts to cultural, historical, and archaeological resources could result from air emissions and pollution, discharges and wastes, bottom disturbance, coastal land use/modification, lighting and visual impacts, and accidental events (i.e., unintended releases into the environment, response activities, and strikes and collisions) associated with ongoing activities from previous OCS oil and gas lease sales (**Table 3.3-2**) as summarized above in **Chapters 4.13.2.1 and 4.13.2.2** of this Programmatic EIS and in greater detail in Chapter 4.5.2 of the GOM Oil and Gas SID. Similar to the IPFs identified for routine OCS oil- and gas-related activities, non-OCS oil- and gas-related activities also influence cultural, historical, and archaeological resources in the GOM through air emissions and pollution; discharges and wastes; bottom disturbance; coastal land use/modification; and lighting and visual impacts. These non-OCS oil- and gas-related IPFs are summarized below with more detailed discussions in Chapter 4.5.2.1 of the GOM Oil and Gas SID.

Air Emissions and Pollution: Similar to air emissions from routine OCS oil- and gas-related activities, air emissions from non-OCS oil- and gas-related sources contribute to acidic deposition, ocean acidification, and eutrophication in the Gulf of Mexico (Caldeira and Wickett 2003; Driscoll et al. 2003b; Howarth 2008; Paerl et al. 2002; Vitousek et al. 1997; Wanninkhof et al. 2015). These emissions are from anthropogenic sources like commercial vessels, military activities, onshore refineries, and recreational fishing vessels, as well as naturally occurring sources like methane seeps, bacterial processes, and other biogenic/geogenic sources. As described above, archaeological resources can deteriorate faster in more acidic environments. However, increased eutrophication as the result of cumulative activities can lead to blooms of phytoplankton, which are consumed by microbes on the seafloor as the bloom dies and settles out. The microbial consumption uses oxygen and can lead to hypoxic or anoxic conditions on the OCS. Through this pathway, eutrophication may, theoretically, enhance shipwreck preservation in some circumstances.

Discharges and Wastes: Non-OCS oil- and gas-related discharges and wastes that could potentially affect cultural, historical, and archaeological resources include historical chemical weapons disposal, historical industrial waste disposal, dredged material disposal, marine trash and debris, non-OCS oil- and gas-related spills, and natural seeps. Many of the impacts from these activities would be related to their associated bottom disturbances as described below. Chemical weapons or industrial waste containers disposed of on top of a historic shipwreck could damage the site through direct physical contact or by chemical alteration of the site’s localized environment, thereby accelerating site degradation. Additionally, these containers, as well as other types of marine trash and debris that reach the seafloor, could affect the ability to accurately interpret archaeological sites in remote-sensing survey data. A concentration of non-archaeological objects on the seafloor could be misinterpreted in sonar data as a potential shipwreck (i.e., false positives), or more likely, magnetic interference from these objects could mask or distort the magnetic signature of an underlying shipwreck buried below the mudline and prevent the accurate archaeological interpretation of magnetometer data (i.e., false negatives). Oil from natural seeps contributes to the region's "background" chemicals, but the magnitude and effects of this oil source are very different from acute effects that would be typical of routine discharges and wastes and unintended releases into the environment from OCS oil- and gas-related activities.

Bottom Disturbance: The majority of non-OCS oil- and gas-related effects to cultural, historical, and archaeological resources would be from bottom-disturbance from State oil and gas activities, artificial reefs, dredging related to sand borrowing or navigation channels, commercial fish trawling, renewable energy installations, military operations, mass wasting events (seafloor mudslides), undersea cables, recreation, and anchoring, buoys, and moorings. Bottom disturbance impacts could also occur from non-OCS oil- and gas-related spills and spill-response activities such as the construction of staging and access areas for cleanup crews and deployment of nearshore spill-response equipment. As described above, the primary negative effects of these activities would be the removal, reorientation, and/or destruction of the artifact assemblage or other physical components of an archaeological site, either unintentionally (e.g., commercial trawling over an unknown archaeological site) or intentionally (e.g., commercial and/or illegal salvage of a historic shipwreck). This, in turn, could result in a loss of archaeological information and inhibit the proper identification and interpretation of the site, potentially affecting a site's eligibility for listing in the NRHP. A secondary negative effect from bottom disturbances is a disruption of the localized environmental conditions, which may accelerate the degradation of an archaeological site.

Many of these activities – due to State jurisdictions, water depth limitations, or their role in supporting coastal infrastructure needs – are more likely to impact historic and pre-contact archaeological resources in relatively shallow near-coastal waters (e.g., State oil and gas, artificial reefs, dredging, trawling, renewable energy, recreation, spill response, and anchor, buoy, and mooring areas). Compared with isolated point-source impacts (such as an anchor or pipeline emplacement), dredging activities have a relatively high potential for bottom-disturbing impacts from the removal of large sediment volumes over contiguous horizontal and vertical areas. In addition to direct physical contact of dredging equipment with archaeological sites in either the dredge pit or the dredged material disposal area, potential impacts also include the redepositing of artifacts into the disposal area and seabed destabilization around sites adjacent to the dredge pit.

Commercial trawl nets that snag on shipwrecks could destroy and disperse artifacts and large sections of vessel hulls, particularly those of wooden-hulled wrecks, which are generally less structurally sound than iron or steel-hulled wrecks. Intrusive trawl netting that snags on a shipwreck and is left behind could also obscure significant sections of the site and preclude a detailed archaeological analysis.

Recreational bottom-disturbing impacts to archaeological sites include treasure hunting/looting and sport diving. Often, specific shipwrecks are targeted and impacts could range from the collection of surface artifacts to the complete destruction and/or removal of the vessel. Sport diving includes private or commercial recreational diving on archaeological sites for pleasure and education. Negative effects to archaeological sites from sport diving may result from boat anchor and mooring damage, disturbance to and removal (looting/souvenir hunting) of artifacts, intentional and unintentional physical contact (body or equipment), and the interaction of exhaled air bubbles with the site. Sport divers may, however, have a beneficial impact to archaeological sites by monitoring sites, encouraging fellow divers to protect sites, and reporting any observed negative impacts to the appropriate State or Federal agency.

Coastal Land Use/Modification: Coastal land disturbance as a result of sea-level rise and subsidence, coastal erosion, dredging of navigation canals, and tourism infrastructure could affect cultural, historical, and archaeological resources similar to bottom-disturbing activities described above, whereby the physical characteristics of an archaeological site are irreversibly altered through direct contact. Coastal land disturbances are relatively less likely to impact historic shipwrecks (except for navigation canal dredging) and more likely to impact pre-contact archaeological sites or other historic buildings, sites, structures, objects, or districts. Dredging equipment or construction of tourism infrastructure may remove, disperse, or destroy features of a historic property if that property is not adequately identified and avoided.

Lighting and Visual Impacts: Any coastal or onshore infrastructure development that introduces lighting impacts or obscures a property's associated viewshed may adversely impact its setting integrity.

Climate Change: Sea-level rise, subsidence, and erosion may result in terrestrial historic and pre-contact sites becoming submerged and their features redistributed through wave energy. Coastal land disturbances can also adversely affect traditional cultural properties by restricting or reducing access or permanently altering characteristics that contribute to their traditional cultural significance.

A single proposed OCS oil and gas lease sale, regardless of alternative, would represent only a small portion of activity when compared to the existing OCS Oil and Gas Program in the GOM (**Table 3.3-2**). In the context of past, present, and reasonably foreseeable OCS and non-OCS oil- and gas-related activities within the area of analysis, the *incremental contribution* of a proposed GOM lease sale to cumulative impacts on cultural, historical, and archaeological resources would be **negligible** when properly mitigated through existing regulatory requirements (**Table 4.13-2**). The cumulative impact of a single OCS oil and gas lease sale coupled with the extensive existing infrastructure would be substantial. That said, oil and gas infrastructure that has been determined to potentially adversely affect historic properties since the passage of the NHPA, in theory, have been sufficiently mitigated. Thus, while the cumulative lighting and visual impacts of oil and gas infrastructure is significant, ongoing adverse effects to specific historic properties (i.e., that have not been mitigated) would be limited. Based on the analysis above, an OCS oil and gas lease sale would not be expected to result in, or have a notable or measurable contribution to, any new or ongoing significant cumulative impacts not already being experienced by cultural, historical, and archaeological resources in the area of analysis.

4.17.14 Land Use and Coastal Infrastructure

Cumulative impacts to land use and coastal infrastructure could result from discharges and wastes, coastal land use/modification, lighting and visual impacts, offshore habitat modification/space-use conflicts, socioeconomic changes and drivers, and accidental events (i.e., unintended releases into the environment, response activities, and strikes and collisions) associated with ongoing activities from previous OCS oil and gas lease sales (**Table 3.3-2**) as summarized above in **Chapter 4.1.2** of this Programmatic EIS and in greater detail in Chapter 4.4.1.2 of the GOM Oil and Gas SID. Similar to the IPFs identified for routine OCS oil- and gas-related activities, non-OCS oil- and gas-related activities also influence land use and coastal infrastructure in the GOM. These activities are also grouped into five IPF categories: discharges and wastes; coastal land use/modification; lighting and visual impacts; offshore habitat modification/space use; and socioeconomic changes and drivers. For a detailed discussion of how non-OCS oil- and gas-related activities can affect land use and coastal infrastructure, refer to Chapter 4.4.1.2 of the GOM Oil and Gas SID.

Discharges and Wastes: Discharges and wastes can impact land use and coastal infrastructure positively and negatively, including onshore dredged material disposal, land-based discharges associated with agricultural uses, trash and debris, and oil spills from State oil and gas activities that occur near or onshore. Dredged material disposal often benefits surrounding land by shoring up areas undergoing subsidence and improving previous land uses. For example, the Coastal Wetlands Park at Port Fourchon, Louisiana, was developed from the beneficial use of dredged materials produced from projects to expand the port's capacity with new slips and deeper canals. Land-based discharges are often associated with agricultural uses and may contribute to negative effects that include pesticide and nutrient runoff and changes in water and soil quality. Also, a negative impact is trash and debris that may accumulate onshore, such as household and industrial trash dumped on vacant lots. Oil spills from State oil and gas activities that may occur near or onshore may negatively affect land use and coastal infrastructure by interfering with the use and viability of those properties and facilities affected.

Coastal Land Use/Modification: Coastal land use/modification impacts to land use and coastal infrastructure are mixed, positive and negative, including agricultural uses, urbanization, maintenance dredging of navigation canals, coastal restoration programs, and tourism infrastructure. Agricultural uses place many demands on the environment and produce negative impacts that include, but are not limited to, habitat fragmentation, pesticide and nutrient runoff, competing urban and agricultural water needs, changes to watershed hydrology, and changes in soil quality. Impacts of urbanization include habitat fragmentation, reduced water and air qualities, and the urban heat island impact. Development related to urbanization takes the place of natural ecosystems and fragments habitat. Maintenance dredging of canals can contribute to wetlands degradation. Coastal restoration programs provide beneficial effects for land use with efforts such as wetlands and marsh restoration and beach nourishment projects. Tourism infrastructure such as parks, beaches, boat launches, and campgrounds contribute positively to land use and coastal infrastructure by attracting visitors who contribute to the local economy, building up State and local revenues that then become available for use in improving various public works, roads, bridges, educational, and health system supports, and future land development or conservation projects.

Also, while there is currently only one operating deepwater port in the GOM region, four oil export facilities and one gas export facility have pending license applications with MARAD, and one LNG project has been approved and is pending license issuance (refer to Chapter 2.7.2.6 of the GOM Oil and Gas SID). If approved, these facilities would entail the construction of new facilities in coastal counties and parishes including San Patricio, Jefferson, Brazoria, and Aransas Counties, Texas; and Cameron and Plaquemines Parishes, Louisiana. These new facilities would be in areas already heavily industrialized by the energy sector and each port application must complete a site-specific NEPA review and CZMA consultation with the affected state(s). Along with the NEPA and CZMA reviews, the Maritime Administration has its own approval criteria, including the use of best available technology to prevent or minimize adverse environmental impacts, that must be met before a license may be issued.

Lighting and Visual Impacts: Lighting and visual impacts can affect land use in coastal areas by detracting from or enhancing the intended use and enjoyment of private and public properties along the coast. Coastal or nearshore lighting from vessels or State oil and gas activities may negatively affect land use by diminishing the visual aesthetics for some recreational sites and detracting from some nature experiences. However, because aesthetics can be subjective, coastal or nearshore lighting can also have positive effects on land use by improving the visibility of structures and adding contrast to the landscape. Potential visual impacts to recreational resources is discussed in **Chapter 4.4.5**.

Offshore Habitat Modification/Space Use: Offshore habitat modification, by definition, does not affect land use and coastal infrastructure. There are some potential issues related to coastal and nearshore space-use conflicts from non-OCS oil- and gas-related activities that may be relevant. These space-use conflicts involve recreation, ports and shipping, sand borrowing and coastal restoration, and renewable energy development. The space-use conflicts considered here occur in coastal or nearshore waters, not on the OCS. Most of these conflicts relate to limited land available for development along the coast that could be used for multiple purposes including recreation, port facilities, etc. Thus, development of these areas generally precludes other types of development and presents a space-use conflict. Refer to Chapter 4.4.1.2 of the GOM Oil and Gas SID for additional examples of potential space-use conflicts associated with these industries.

Socioeconomic Changes and Drivers: Socioeconomic changes and drivers that may affect land use and coastal infrastructure are numerous. Although not an exhaustive list, the possible related non-OCS oil- and gas-related activities that are typically considered by BOEM include oil and gas activity in State waters; onshore oil and gas activities (includes private, State, and Federal lands); transportation systems and ports; construction and maintenance of industrial facilities; agricultural uses; urbanization; demographic shifts (in-migration, out migration); evolution of State and Federal regulations; planning and zoning; development of residential areas and recreational facilities; modifications to public facilities (such as water, sewer, educational, and health facilities); military activities; fluctuations in global commodity markets; global, national and regional economic trends; and more recently, global pandemics. The cumulative impacts of these multivariate factors are diverse, wide-ranging and intertwined in a complex web of interacting impacts that may be positive or negative depending on perceptions of the individuals and entities involved. For example, construction or expansion and maintenance of non-OCS-related industrial facilities, such as paper mills and aluminum plants, could affect land use and coastal infrastructure depending on proximity and scale of the work being done. Similarly, while there is currently only one operating deepwater port in the GOM region, four oil export facilities and one gas export facility have pending license applications with MARAD, and one LNG project has been approved and is pending license issuance (refer to Chapter 2.7.2.6 of the GOM Oil and Gas SID). Positive impacts could occur for the industry obtaining improvements, but negative impacts could occur to nearby natural landscapes, agricultural areas, or air and water quality. However, NEPA and CZMA reviews, along with the Maritime Administration own approval criteria, should minimize adverse environmental impacts from any new deepwater port facilities. Given the complexity and wide-ranging nature of socioeconomic changes and drivers, there may be some small and measurable benefits for employment, improvements to local infrastructure and community services, and there could be some adverse localized impacts that may disrupt uses temporarily.

Other IPFs or programmatic concerns not already discussed as part of existing conditions, but which are reasonably foreseeable and could contribute to cumulative impacts to land use and coastal infrastructure, include natural processes and climate change.

Natural Processes**:** Tropical storms have continued to negatively impact land use and coastal infrastructure. Hurricane Nicholas made landfall 50 mi (80 km) south of Houston as a Category 1 hurricane on September 14, 2021, temporally shutting down the Colonial Pipeline (supplying natural gas to the East Coast) and closing the Houston Ship Canal for weeks. On August 29, 2021, Hurricane Ida made landfall near Port Fourchon as a Category 4 hurricane, shutting down an estimated 96 percent of OCS petroleum crude production, 94 percent of its natural gas production, and closing or damaging nine or more refineries. Flood control systems, much improved since Hurricane Katrina, helped protect the New Orleans urban area from Hurricane Ida's devastating flooding but failed to protect coastal and outlying areas. Hurricane Ida's infrastructure damages are substantial, and production was not expected to return to normal until October 2021 and infrastructure repairs are expected to take much longer (Energy Information Administration 2021).

Climate Change: Climate change continues to negatively impact land use and coastal infrastructure through ongoing substantial coastal land loss resulting from erosion, subsidence, sea-level rise, and more severe and numerous storms that threaten important infrastructure, critical wetlands, barrier islands, coastal communities, and inland communities as inland waterways flood more frequently causing widespread property damage and dislocating residents and businesses. Coastal land loss is one of the greatest threats to the stability and future of OCS oil- and gas-related infrastructure, producing a major negative impact to those facilities located close to areas vulnerable to land loss. Gulf Coast States are taking steps of varying degrees to address land loss and other issues of concern exacerbated by climate change. The Texas Coastal Resiliency Master Plan originated in 2017 and focuses on funding projects to address coastal vulnerabilities, aims to be an adaptable plan, and fosters communication with the public regarding the value of the Texas Coast and its preservation (Oyer 2021). In January 2023, Louisiana published the 2023 Louisiana's Comprehensive Master Plan for a Sustainable Coast, which follows three previous Master Plans that started after Hurricane Katrina in 2005 with the goal of countering the severe land loss that continues along the Louisiana coast (over 2,000 square miles lost since 1932) (Coastal Protection and Restoration Authority of Louisiana 2023). In addition to the Master Plan, Louisiana has a Climate Initiatives Task Force that created an action plan to address climate change impacts in the state (Climate Initiatives Task Force 2022).

Critical infrastructure along the Gulf Coast, such as Port Fourchon, continues to be threatened by the ongoing effects of climate change. Masters (2019) notes that the impacts of climate change, especially warmer ocean temperatures, are making slow-moving storms more common and more damaging, as they can sit over one location for longer periods of time, increasing the amount of precipitation seen in an area. It also contributes to sea-level rise, which is one factor in the loss of coastal lands felt across the Gulf of Mexico, but most acutely in Louisiana.

A single proposed OCS oil and gas lease sale, regardless of alternative, would represent only a small portion of activity when compared to the existing OCS Oil and Gas Program in the GOM (**Table 3.3-2**). In the context of past, present, and reasonably foreseeable OCS and non-OCS oil- and gas-related activities within the area of analysis, the *incremental contribution* of a proposed GOM oil and gas lease sale to cumulative impacts on land use and coastal infrastructure would be **negligible**. Based on the analysis, an OCS oil and gas lease sale would not be expected to result in, or have a notable or measurable contribution to, any new or ongoing significant cumulative impacts not already being experienced by land use and coastal infrastructure in the area of analysis.

4.17.15 Economic Factors

Cumulative impacts to economic factors could result from socioeconomic changes and drivers, unintended releases into the environment, response activities, and strikes and collisions associated with ongoing activities from previous OCS oil and gas lease sales, as summarized above in **Chapter 4.15.2** and in greater detail in Chapter 4.4.7 of the GOM Oil and Gas SID.

Socioeconomic Changes and Drivers: Similar to the IPFs identified for routine oil- and gas-related activities, non-OCS oil- and gas-related activities also influence economic factors in the GOM. BOEM utilizes projected data to analyze the impact of various industries and economic factors. For instance, they consider how changes in the oil and gas industry can affect supply and demand for energy products. Factors such as onshore energy production, commodity price fluctuations, international trade flows, geopolitical developments, and societal disruptions can influence the industry. Economic activity, technological advancements, and government policies also play a role in shaping energy product demand. Additionally, supply and demand for OCS oil and gas may be impacted by U.S. policies as it transitions to a clean energy future. The U.S. currently consumes significant volumes of crude oil and natural gas, and forecasts suggest that will continue over the next decade regardless of future policy changes. However, if the U.S. develops more policies to combat climate change and meet net-zero emissions goals, there may be larger impacts to supply and demand of oil and natural gas. For example, the Inflation Reduction Act offers funding, programs, and incentives designed to accelerate the transition to a clean energy economy and drive significant deployment of new clean energy resources.

Substitution effects from the Inflation Reduction Act and other Federal and State policies promoting reduced carbon emissions and the use of renewable energy sources will have an increasingly notable influence on the energy sector and overall economics of the region over time. In the event of major changes in oil demand or other policies that restrict activities on the OCS, there could be significant declines in GOM oil and gas production and associated economic activity. However, the GOM currently has over 2,100 active leases that play a pivotal role in regional energy economics and employment and are expected to do so for years to come. The potential for major changes in oil demand or the implementation of policies that restrict oil and gas activities on the OCS could lead to substantial declines in GOM oil and gas production over time, affecting associated economic activity. Job losses, revenue fluctuations, and broader economic conditions hinge on how these elements interact. By assessing both short-term impacts and long-term implications, BOEM can make informed decisions that balance economic growth with environmental stewardship. For a detailed discussion of how non-OCS oil- and gas-related activities can affect economic factors, refer to Chapter 4.4.7 of the GOM Oil and Gas SID.

Non-OCS oil- and gas-related activities occur concurrently with an expansive existing OCS Oil and Gas Program in the GOM. BOEM measures these activities as part of the baseline economic conditions in the GOM region by utilizing economic data provided by Woods & Poole Economics, Inc., which considers historical data trends and provides forecasts of various economic variables over time, as discussed in Chapter 4.4.7.1 of the GOM Oil and Gas SID. The Woods & Poole Economics, Inc. data include contributions of likely activities and trends based on local and regional data, as well as likely changes to economic and demographic conditions.

Climate Change: Climate change is broadly defined as the increase in global temperature and related chemical and physical changes resulting from the release of certain pollutants associated with anthropogenic activities. Chief among the drivers of climate change are increasing atmospheric concentrations of carbon dioxide and other greenhouse gases such as methane, nitrous oxide, and several fluorocarbons. These greenhouse gases change the atmosphere's chemical and physical properties, altering temperature, humidity, wind, and precipitation patterns globally. These changes in turn affect the biological and human environment. Changes in many extreme weather and climate events have been linked to human influences, including a decrease in cold temperature extremes, an increase in warm temperature extremes, an increase in extreme high sea levels, and an increase in the number of heavy precipitation events in a number of regions (Intergovernmental Panel on Climate Change 2014). In the GOM, such offshore operations and platforms are vulnerable to tropical storms and extreme wave heights (Varianou Mikellidou et al. 2018). Climate change may impact regional economic factors through increased vulnerability to extreme weather events, rising sea levels and coastal erosion, changes in temperature and precipitation patterns, regulatory and policy changes, and the economic implications of changing energy markets. BOEM's greenhouse gas emissions modeling analysis includes estimates of the social costs of life-cycle GHG emissions associated with the proposed action (refer to **Appendix H**).

A single proposed OCS oil and gas lease sale, regardless of alternative, would represent only a small portion of activity when compared to the existing OCS Oil and Gas Program in the GOM (refer to **Table 3.3-2**). In the context of past, present, and reasonably foreseeable OCS and non-OCS oil- and gas-related activities within the area of analysis and the substantial prevalence and influence of OCS oil- and gas-related activities to the regional economy (particularly Louisiana and Texas), the *incremental contribution* of a proposed GOM oil and gas lease sale to cumulative impacts on economic factors would range from **minor** to **moderate beneficial**. New projects from an OCS oil and gas lease sale would more likely provide continued work for the existing workforce rather than create new jobs. Conversely, the incremental impacts from the cancellation of a single OCS oil and gas lease sale could result in **negligible** to **moderate adverse** cumulative effects to the GOM's long-term economic prospects, depending on how industry responds (**Chapter 2.2.1**).

4.17.16 Social Factors (Including Environmental Justice)

Cumulative impacts to social factors could result from the ongoing activities associated with previous OCS oil and gas lease sales (**Table 3.3-2**) as summarized above in **Chapter 4.16.2** and in greater detail in Chapter 4.4.6.2 of the GOM Oil and Gas SID. Similar to the IPFs identified for routine OCS oil- and gas-related activities, non-OCS oil- and gas-related activities also influence social factors in the GOM through the following IPFs: air emissions and pollution; discharges and waste; bottom disturbance; noise; coastal land use/modification; lighting and visual impacts; offshore habitat modification/space use; and socioeconomic changes and drivers. These potential cumulative impacts to social factors are summarized below and discussed in greater detail in Chapter 4.4.6.2.1 of the GOM Oil and Gas SID.

Based on the analysis of the IPFs above, the impacts from ongoing OCS oil- and gas-related activities can range from **minor beneficial** to **moderate adverse** but are widely distributed and expected to have limited regional impacts because of the existing extensive and widespread support system for the petroleum industry and its associated labor force. This range represents on one end, maintaining employment in oil- and gas-related industries (which has both positive and negative impacts on social factors like family stability and traditional subsistence practices), to on the other hand, the impacts of accidental events like major collisions or large spills and subsequent response activities that could temporarily impact several counties/parishes. For example, a tanker collision with fuel barge DM932 in 2008 resulted in 270,000 gallons of spilled fuel oil, causing significant economic disruptions as well as ecological damage (NOAA 2022).

Air Emissions and Pollution: Air pollutants are released by human activity (i.e., industrial activity, combustion engines, agriculture, and consumer products) and include those regulated under the Clean Air Act. Many can also be released by non-human activity like forest fires, high winds, natural seeps, decay of solid waste, and lightning. These releases can negatively affect human health, degrade habitats of culturally and economically significant plant and animal species, damage cultural and archaeological resources, impede visibility, contribute to ocean acidification, and impact weather, climate, and manmade materials.

As a pertinent example, in recent years Louisiana's Gulf of Mexico region has experienced both increased releases of toxic chemicals from petrochemical plants (increasing the hazards to which nearby communities are exposed) and a decreased budget and staffing of the State regulatory and enforcement agency that monitors air quality (Schleifstein 2019a; 2019b). In 2022 the USEPA published a Letter of Concern that brought attention to both cumulative impacts on African-American populations throughout the "Industrial Corridor" (the stretch of the Mississippi River between New Orleans and Baton Rouge) as a result of air emissions and also specifically with an existing facility impacting a mostly African-American attended elementary school (USEPA 2022b). Later in 2023, the USEPA terminated their complaint after negotiations with the Louisiana Department of Environmental Quality to incorporate cumulative impact analyses into their environmental reviews failed, although a lawsuit against the above-mentioned facility continues (Parker and WWNO 2023). Detailed quantitative information is not available to determine to what extent OCS extracted petroleum contributes to operations along the Industrial Corridor. It is reasonable to assume that the products from OCS oil and gas development and production and their supporting infrastructure make the area attractive to petrochemical refining businesses (Dismukes 2021; LOOP LLC 2023; Peterson 2000; Priest 2022).

More generally, recent research has shown that, nationally, schools with higher concentrations of people of color (particularly Black or African American, Asian or Asian/Pacific Islander, and Hispanic) and students eligible for the Federal free or reduced lunch program (used as a proxy for determining low-income status) are collocated in areas with higher concentrations of NO_2, and to a lesser extent, $PM_{2.5}$. This disproportionate experience with air pollutants by race/ethnicity and poverty level is not only linked to a general urban-rural divide but, especially by race/ethnic classification, is also seen within the same environments. Air pollution can affect health and cognitive function, and children are especially vulnerable, in part because their bodies are still developing (Cheeseman et al. 2022; NASA 2023). As discussed in **Chapters 4.1.1 and 4.1.2.4**, urban areas are likely to experience the highest effects from cumulative air emissions and pollution. Downstream facilities, particularly refineries and petrochemical plants, are discussed in more detail in **Chapter 4.16.4.1** of this Programmatic EIS and Chapter 4.1.1 of the GOM Oil and Gas SID. Cumulative impacts on air quality are discussed in more detail in **Chapter 4.1**.

Discharges and Wastes: Discharges and wastes can have both adverse and beneficial effects on social factors and environmental justice. Point- and nonpoint-source pollution of liquid and solid waste (including plastics) from multiple sources (e.g., industrial, agricultural, and urban) can pollute the air and water used by people, causing acute and chronic effects, and can contaminate the habitat of species used for subsistence, including subsistence fishing, making them unavailable or unsafe for use by environmental justice and other communities. Conversely, dredged material disposal often benefits surrounding land by shoring up areas undergoing subsidence and making improvements that can be used for parks, recreation, and fishing.

Varying water quality from municipal water supplies can have far-reaching impacts for coastal communities, as has recently been demonstrated in Plaquemines Parish, Louisiana. Since June 2023 the parish's drinking water has been impacted by a "saltwater wedge" moving up the Mississippi River due to the river's low water volume (Louisiana Department of Health 2023). In September 2023 a temporary sill constructed by the USACE was overtopped and had to be augmented (Kenning 2023; USACE 2023). Afterwards a Federal disaster was declared on September 27, 2023 (The White House 2023). The USACE began barging water to Plaquemines Parish and three desalination units were also installed in the parish, while neighboring parishes of Orleans and Jefferson began making plans in case the wedge moved farther upriver, such as beginning to install pipelines for new intakes (Chavez 2023). Increased sodium in the water can affect individuals with "kidney problems, hypertension, infants and pregnant women," can cause heavy metal intrusion from lead and galvanized steel pipes, damage appliances with water hookups, as well as affect agriculture, livestock, and the seafood industry (e.g., ice for shrimp boats had to be shipped in from outside the impacted areas to shrimp docks) (Kenning 2023). The full impacts, including community health, infrastructure, or economic damages have yet to be determined. Plaquemines Parish contains many environmental justice populations and is of particular interest to BOEM due to its connection to the offshore oil and gas and supporting industries, as well as other OCS activities more generally (Austin et al. 2014a; 2014b).

Bottom Disturbance: Bottom disturbance from activities such as dredging, trawling, and marine construction can have negative and positive effects on social factors and environmental justice. It can disrupt habitat (through turbidity and sedimentation or physical displacement) for species, including oysters and other shellfish, making them unavailable for consumption or commerce. Conversely, the installation of production structures related to State oil and gas activities, as well as artificial reef placement could enhance reef fish habitat and thus improve fishing and diving opportunities by congregating some fish populations near the structures.

Noise: Anthropogenic noise from non-OCS oil- and gas-related sources including State oil and gas activities, industrial activity, and construction, can negatively affect animal behavior (refer to **Chapters 4.3-4.9**), which could indirectly affect social factors if notable disruptions to aspects like catch rates or cultural practices were to occur.

Lighting and Visual Impacts: Artificial lighting can be installed for public safety and to facilitate nighttime industrial work, enjoyment of outdoor spaces, and fishing after dark, creating positive effects. However, it can also contribute to light pollution and be disruptive to certain species and other human uses of nighttime spaces, such as recreation (including star gazing, camping, and fishing). Visual impacts can possibly disrupt the sense of place of a community or its cultural, historic, and archaeological resources.

Coastal Land Use/Modification: Coastal land use, whether residential, commercial, or agricultural, and the zoning ordinances or planning documents that constrain or promote it can have negative and positive effects on people, habitats, and the environment, depending on how they stand to benefit or not from various proposed projects. Environmental justice communities may be particularly sensitive to changes in coastal land use, either positive or negative, because they may have culturally significant practices that rely on the use of coastal lands or they may lack the financial resources to travel or otherwise replace lost use. Land use decisions can be controversial and simultaneously considered positive by some stakeholders and negative by others.

Those who rely on subsistence fishing can also be particularly impacted by coastal land use policies and this can have subsequent impacts on social factors, as subsistence practices are deeply embedded in the social fabric of coastal Louisiana communities. Recent research on subsistence in Louisiana noted that subsistence practitioners rarely consider their activities as “subsistence”, see their activities as important markers of identity and heritage, and that subsistence products move across wide social networks, including family and friends, community members, and as part of community events (Regis and Walton 2022; Regis et al. 2022a; 2022b; 2022c). The authors further note that impacts to subsistence practices in these communities could have environmental justice implications as these practices can support vulnerable community members. McCall and Greaves (2022) make similar conclusions about subsistence activities in Louisiana, noting that they contribute to cultural identity, place attachment, and that the products move about in a wider social system of sharing and delayed reciprocity within informal economies. Refer to Chapter 4.4.4 of the GOM Oil and Gas SID for more on subsistence fishing in the region.

Offshore Habitat Modification/Space Use: Offshore habitat modification/space use can negatively and positively affect communities and society in the area of analysis. There are many competing interests for offshore land and water, including commercial and recreational fishing (which at times compete with each other), aquaculture, State offshore oil and gas and renewable energy, marine minerals (including sediment for coastal restoration projects), coastal restoration projects, military activities, transportation, tourism and recreation, protected areas (including cultural resources, marine protected areas, and critical habitat), and other industries.

Socioeconomic Changes and Drivers: Socioeconomic drivers have arguably the largest effect on social factors and environmental justice, both positive and negative. The contraction and expansion of key industries contribute to the economies, onshore and offshore land use, visual impacts, and subjective experience of living in the area. As industries expand and contract, they may compete directly or indirectly for land, workers, public perception, and government funding or assistance. Competition for workers is recognized as a significant challenge for industries, particularly those with unpredictable or cyclical employment needs, such as oil and gas and shipbuilding and fabrication (Austin et al. 2002a; Austin and Woodson 2014; McGuire et al. 2014).

Other Cumulative Factors: Other IPFs not accounted for above but which contribute to cumulative impacts to social factors, include interrelated factors such as harmful microorganisms, coastal land loss, major storm events, and climate change. How these factors impact communities is uneven and depends on many other factors, though research is still ongoing to understand the impacts and variation. Refer to Chapter 4.4.6 of the GOM Oil and Gas SID for additional information on recent research regarding the effect that climate change is having on various communities.

The incidence of harmful algal blooms is expected to continue, causing additional indirect stress to social factors by causing or exacerbating die-offs of fish, shellfish, corals, and aquatic plants (Obenour et al. 2013; Rabalais et al. 2002; Turner et al. 2005; 2012) of significant economic or cultural value. Red tide, cyanobacteria, and vibrio, among others can pose dangers for humans and other animals who come into contact with or ingest them, causing disruptions in fishing and water and beach access. This can interfere with people's use and enjoyment of the natural environment and contribute to negative cumulative effects to GOM coastal populations.

Coastal land loss from erosion, subsidence, sea-level rise, and storm surge is one of the greatest threats to the stability and future of coastal populations, especially in Louisiana. Figures 4.4.6-7 and 4.4.6-8 of the GOM Oil and Gas SID illustrate projections for future land loss in Louisiana. Louisiana has created a Coastal Master Plan focused on resolving the land loss crisis (Coastal Protection and Restoration Authority of Louisiana 2023). As of 2022, Louisiana's Coastal Protection and Restoration Authority had overseen over $20 billion in allocated State and Federal funds with 92 projects in construction, 41 projects in engineering and design, and 9 projects in planning stages (LCPRA 2022a; 2022b). Restoration projects would also impact habitats, communities, and residents. In 2022, the USACE released their Final EIS for the Mid-Barataria Sediment Diversion Project in Plaquemines Parish, Louisiana. The Final EIS identified minor to moderate, permanent, adverse impacts on the economy, populations, property and housing values, tax revenues, public service, and community cohesion for the communities surrounding the proposed project; moderate to major, permanent, adverse impacts to shrimp and oyster fisheries; and carry with it possible disproportionately high and adverse impacts to local environmental justice populations (Lipsman 2019; 2020; McCall and Greaves 2022; USACE 2022).

Natural Processes: Major storm events have had disproportionate effects on minority and low-income populations, especially in coastal areas and zones in Louisiana outside levee protection (Hemmerling and Colten 2004; Peterson 2012); therefore, these groups are more vulnerable to any new hazards or natural disasters (Goldstein et al. 2011). High-intensity storms, coupled with higher sea levels, are reasonably foreseeable and likely to cause additional stress to social factors cumulatively. The Gulf Coast of Texas, Louisiana, Mississippi, Alabama, and Florida have experienced multiple hurricanes in recent years. Of these, Category 4 Hurricanes Laura (with Delta following), Ida, Ian, and Idalia were particularly devastating, prompting multi-year regionwide recoveries in southwestern Louisiana, southeastern Louisiana, and southwestern, central, and northwestern Florida, respectively. The full impacts of these hurricanes, including those to social factors, likely will not be known for years to come; however, the impacts to coastal communities, including infrastructure, residences, businesses, and demographics were substantial. Refer to **Chapter 3.6.12** of this Programmatic EIS and Chapter 3.3.1 of the GOM Oil and Gas SID for more information on major storms affecting the Gulf Coast.

Climate Change: Climate change is altering many different facets of life across the area of analysis. For example, in a study of residential property in Florida and risk from climate change, the authors found that Florida is at risk of increased flooding and property devaluation related to climate change impacts. These risks are unevenly distributed, and five of the nine counties expected to see the most devaluation are along the Gulf Coast. Additionally, all of the counties expected to see the highest percentage of homes exposed to flooding are along the Gulf Coast (Woetzel et al. 2020). Sea-level rise could significantly shift U.S. population distribution. Using a scenario of 1.8-m (5.9-ft) sea-level rise between 2010 and 2100, Hauer predicts that Florida and Louisiana are likely to lose the most population from sea-level rise-induced migration (2.5 million and 0.5 million, respectively), with Texas likely to gain the most population (nearly 1.5 million), while Alabama and Mississippi experience slight gains (Hauer 2017). Refer to Chapter 4.4.6 of the GOM Oil and Gas SID for more on the effects of climate change to social factors in the Gulf of Mexico region and also how climate change may disproportionately affect environmental justice communities.

A single proposed OCS oil and gas lease sale, regardless of alternative, would represent only a small portion of activity when compared to the existing OCS Oil and Gas Program in the GOM (**Table 3.3-2**). Refer to Chapter 4.16.3.2 for a further analysis of impacts under Alternative A (No Action Alternative) wherein a single proposed lease sale would not take place and the potential impacts would not occur. Ongoing non-OCS oil- and gas-related factors, which include all human activities, natural events, and processes, contribute more to cumulative impacts than do factors related to OCS oil- and gas-related activities alone because of the analysis area's complex socioeconomic framework.

The spatial distribution of activities could vary across action alternatives; however, the overall types of activities and the estimated levels of those activities would be similar. In the context of past, present, and reasonably foreseeable OCS and non-OCS oil- and gas-related activities and cumulative impacts to social factors within the area of analysis, the *incremental contribution* of an OCS oil and gas lease sale to cumulative impacts is expected to be **minor adverse** for Alternative B, C, or D, as impacts from a single proposed OCS oil and gas lease sale would not disrupt the normal or routine functions of an affected activity or community. The petroleum industry as a whole in the Gulf of Mexico region has matured over nearly a century and is well-developed, expansive, extensive, and deeply intertwined in the regional communities and economies of the five Gulf Coast States. For much of the Gulf of Mexico region, offshore lease sales and offshore development are part of the routine fabric of communities. Based on the analysis above, an OCS oil and gas lease sale would not be expected to result in, or have a notable or measurable contribution to, any new or ongoing significant cumulative impacts not already being experienced by social factors in the area of analysis.

4.17.17 Summary of Cumulative Impacts

Multiple IPFs are likely to affect GOM resources in the coming decades, including but not limited to, invasive species, nutrient runoff and pollution, marine traffic, coastal development, military and other Federal activities, climate change, and ongoing and future OCS oil- and gas-related activities. For example, noise from deep-penetration seismic surveys or decommissioning may disturb or injure marine mammals, sea turtles, and fish. Lingering effects from the *Deepwater Horizon* explosion, oil spill, and response, as well as increased ocean temperature and acidity, may challenge many marine and estuarine communities, including coral reefs and other hard-bottom benthic communities. Commercial and recreational fishing may impact some benthic communities, levels of harvested fish species, and bycatch. Rising demand for sand and increased dredging may degrade benthic communities and may disturb, injure, or kill sea turtles. Coastal and estuarine habitats along the Gulf Coast may be subjected to runoff and pollution, which may degrade water quality. Increases in vessel traffic, coastal development, and sea-level rise may influence coastal erosion. Coastal habitats and communities (particularly wetlands) are threatened by subsidence, erosion, sediment starvation, and sea-level rise. Tourism is expected to continue to be an important driver, though more so in the EPA, where OCS oil- and gas-related activities are far less prevalent and activities related to future OCS oil and gas lease sales are not reasonably foreseeable (BOEM 2023b).

As noted in the 2024-2029 National OCS Oil and Gas Program Programmatic EIS, the WPA and CPA have low levels of expected impacts resulting from the 2024-2029 National OCS Oil and Gas Program (which includes up to 3 GOM oil and gas lease sales) and future oil and gas leasing (BOEM 2023b). In general, BOEM expects fewer new facilities across the GOM shelf and deepwater environment as a result of future OCS oil and gas leasing when compared to historical trends, with deepwater facilities yielding most of the oil production. Additionally, even though continued consumer demand for oil and gas is likely, new advances in upstream and downstream technology could potentially change the level of projected OCS oil- and gas-related activities for future OCS oil and gas lease sales and how they are conducted. Based on the scenario projections in **Chapter 3.3**, it is reasonable to assume the future effects from the Cumulative OCS Oil and Gas Program would likely be similar to those in the past and under existing conditions. Utilizing existing infrastructure lessens the impacts of bottom/land disturbance, lighting, and routine discharges on various resources, and impacts from additional noise, vessel traffic, and visible infrastructure are not expected to be noticeable (by humans) above future baseline conditions. Furthermore, additional mitigating measures to reduce or minimize any potentially significant impacts of concern can and may be applied during post-lease reviews. Therefore, the presence of a well-developed oil and gas industry and robust regulatory oversight in the GOM leads to a low relative addition to overall cumulative effects from a single OCS oil and gas lease sale.

Based on the analyses above and incorporated by reference, an OCS oil and gas lease sale would not be expected to result in, or have a notable or measurable contribution to, any new or ongoing significant cumulative impacts not already being experienced by most resources in the area of analysis, including coastal communities and habitats, benthic communities and habitats, pelagic communities and habitats, fish and invertebrates; birds; commercial fisheries; recreational fishing; recreational resources; cultural, historical, and archaeological resources; land use and coastal infrastructure; and social factors.

The incremental contribution of an OCS oil and gas lease sale's impacts to air quality could result in **moderate** to **major** cumulative air quality impacts if notable and measurable levels of O_3 caused by the proposed action were to reach the Houston-Galveston-Brazoria area, thus slowing down the long-term ability of the area to recover from the chronic nonattainment status for O_3 currently experienced. There are several existing regulatory programs and requirements in place, however, to reduce or minimize cumulative impacts to air quality in the GOM at all stages of OCS oil and gas development (**Table 4.1-2**). Therefore, additional or worsened significant cumulative impacts to air quality as a result of an OCS oil and gas lease sale, though possible, would not be likely. Routine activities and the most likely types of accidental events expected as a result of an OCS oil and gas lease sale would not be expected to result in, or have a notable or measurable contribution to, any new or ongoing significant cumulative impacts to water quality. However, there is the potential for a large spill (e.g., ≥1,000 bbl) to result in up to **moderate** cumulative impacts to water quality depending on the characteristics of the spill, baseline conditions at the time of the event, and weather and oceanographic conditions, among other variables. Refer to the GOM Catastrophic Spill Event Analysis technical report (BOEM 2021c) for an assessment of potential impacts resulting from a low-probability catastrophic spill in the GOM similar in nature to the *Deepwater Horizon* explosion, oil spill, and response, which is not part of the action alternatives.

Incremental impacts from an OCS oil and gas lease sale due to noise, entanglement, unintended releases (oil spills), and vessel strikes could potentially result in **moderate** to **major** cumulative impacts to marine mammals and sea turtles if not mitigated. However, with the application of mitigating measures, stipulations, and consultation requirements (refer to **Tables 4.8-2 and 4.9-2**), these impacts would likely be **negligible** to **moderate** and not expected to result in, or have a notable or measurable contribution to, any new or ongoing significant cumulative impacts to marine mammals or sea turtles. The exception would be if a vessel associated with an OCS oil and gas lease sale were to strike an ESA-listed species and result in population-level effects to the extent that the viability of the population was diminished. Furthermore, the Notification of Intention to Transit Rice's Whale Area COA avoids or mitigates potential vessel interactions with Rice's whales in the northeastern GOM. Given the proposed critical habitat for the Rice's whale (88 FR 47453), additional mitigating measures through ESA consultation may be applied as necessary as part of an OCS oil and gas lease sale or during post-lease reviews.

Generally, a single OCS oil and gas lease sale would have a **minor** to **moderate beneficial** contribution to cumulative economic impacts given the substantial prevalence and influence of OCS oil- and gas-related activities to the regional economy (particularly in Louisiana and Texas). New projects from an OCS oil and gas lease sale would provide continued work for the existing workforce more so than create new jobs. Conversely, the incremental impacts from the cancellation of a single OCS oil and gas lease sale could result in **minor** to **moderate adverse** cumulative effects to the GOM's long-term economic prospects, depending on how industry responds (**Chapter 2.2.1**). Overall, global emissions would likely increase in each activity level under the action alternatives (refer to **Appendix H**). However, BOEM acknowledges the limitations and uncertainty in the modeling and what implications the incremental contribution to global GHGs might have to cumulative impacts from future climate change.

4.18 UNAVOIDABLE ADVERSE IMPACTS

Unavoidable adverse impacts associated with Alternatives B-D are summarized below. All OCS oil- and gas-related activities involve temporary and exclusive use of relatively small areas of the OCS over the lifetimes of specific projects. Lifetimes for these activities can be days, as in the case of seismic surveys, or decades, as in the case of a production structure or pipeline. No activities in the OCS Oil and Gas Program involve the permanent use of large areas of the OCS. However, certain allowances can be granted on a case-by-case basis to decommission in place by BSEE's Regional Field Operations Regional Supervisor if the equipment is determined not to be an obstruction (30 CFR § 250.1700(b)). Cumulatively, however, a multitude of individual projects results in a major use of OCS space. Where feasible, mitigating measures (**Chapter 2.3**) are applied to reduce the impacts of a proposed action. Unavoidable adverse impacts have been identified for many of the resources described in this chapter and are summarized below.

***Air Quality*:** Unavoidable adverse impacts on air quality would occur through air emissions from sources such as offshore engine combustion, spill events (evaporation and volatilization of the lighter components of crude oil), and spill-response activities (combustion from surface burning and aerial spraying of dispersant chemicals). Additionally, adverse impacts could last the life of the project since oil and gas production is a source of pollutants that can be minimized through regulation but not eliminated.

***Greenhouse Gas Emissions*:** Unavoidable impacts to the climate would occur through emissions related to the life cycle of the produced hydrocarbons. The contribution of the greenhouse gases from this proposed action would add to the global carbon budget and contribute to global climate change (refer to **Appendix H**).

***Water Quality*:** Routine offshore operations would cause some unavoidable adverse impacts to varying degrees on the surrounding water quality. Drilling, construction, overboard discharges of drilling mud and cuttings, and pipelaying activities would cause an increase in the turbidity of the affected waters for the duration of the activity periods. This, however, would be a localized impact and only affect water in the immediate vicinity of the construction activity or in the vicinity of offshore structures, rigs, and platforms. Mitigation of impacts from these activities would be accomplished through existing NPDES regulations. Accidental spills from platforms and the discharge of produced waters could result in increases of hydrocarbon levels and trace metal concentrations in the water column in the vicinity of the platforms. Spilled oil from a tanker collision would affect the water surface in combination with dispersant chemicals if they are used during spill response. A subsurface spill would subject the surface, water column, and near-bottom environment to spilled oil and gas released from solution, dispersant chemicals, or emulsions of dispersed oil droplets and dispersant chemicals.

Unavoidable impacts to onshore water quality would occur as a result of chronic point- and nonpoint-source discharges such as runoff and effluent discharges from existing onshore infrastructure used in support of lease sale activities. Vessel traffic contributes to the degradation of water quality by chronic low-quantity oil leakage, treated sanitary and domestic waste, bilge water, and contaminants known to exist in ship paints. These impacts would be mitigated by the Vessel Incidental Discharge National Standards of Performance published by the USEPA. Regulatory requirements of the State and Federal water authorities and some local jurisdictions would be applicable to point-source discharges from support facilities such as refineries and marine terminals.

Coastal Communities and Habitats: Some unavoidable impacts would occur during pipeline and other related coastal construction, but regulations are in place to avoid and minimize these impacts to the maximum extent practicable. Unavoidable impacts resulting from dredging, wake erosion, and other secondary impacts related to channel use and maintenance would occur as a result of a proposed action. If an oil spill contacts coastal wetlands, adverse impacts could be notable in localized areas. In heavily oiled areas, wetland vegetation could experience suppressed productivity for several years; in more lightly oiled areas, wetland vegetation could experience die-back for one season. Much of the wetland vegetation would recover over time, but some wetland areas could be converted to open water. Oil spills and response activities could result in adverse impacts to beaches if the sand is removed and not replaced, and a beach could experience several years of small surface residue balls (also called tarballs) washing ashore over time.

Benthic Communities and Habitats: Unavoidable adverse impacts to benthic communities and habitats would occur if unintended releases to the environment and subsequent response activities were to contact sensitive benthic resources. The vulnerability of benthic habitats to an accidental release of oil or other contaminants from a surface vessel, well, pipeline, etc. would depend on the combination of several components: spill location (surface or subsurface); spill volume; and applied spill-response methods. The majority of accidental spills are small in volume (**Chapter 3.5.1.1**, under the subheading Offshore Spills <1,000 bbl), and the impacts from a single, non-catastrophic spill would be localized and only impact a small portion of the overall resource population in the GOM (i.e., a small number of individual organisms). However, due to their relatively small numbers and restricted habitat, the impacts from unintended releases to the environment to ESA-listed corals and designated coral critical habitat would be greater than for other benthic species.

Pelagic Communities and Habitats**:** Unavoidable adverse impacts would take place if an oil spill occurred and contacted plankton or *Sargassum* at the surface. There would be some adverse impacts on organisms contacted by oil, dispersant chemicals, or emulsions of dispersed oil droplets and dispersant chemicals that, at this time, are not completely understood. However, the basin-wide distribution and abundance of plankton and *Sargassum* in the northern GOM would allow for rapid recovery of any affected areas through natural mixing (i.e., currents, wind, and tides) once the plume dissipates (i.e., evaporate, weathers, and biodegrades). Further, plankton have a naturally high mortality rate and *Sargassum* has a yearly cycle that promotes quick recovery.

Fishes and Invertebrates: Underwater sound produced from a variety of OCS oil- and gas-related activities (e.g., vessel traffic, seismic surveys, and explosive decommissioning) would result in some level of communication masking, behavioral change, recoverable injury, and/or mortality to exposed individuals regardless of whether the activity is distanced from hard bottom habitats (e.g., exposed individuals in soft bottom and pelagic habitats would still experience impacts). Depending on a multitude of factors (e.g., exposure level and duration, life stage, and mobility), unintended releases into the environment could result in mortality, decreased fitness, or behavioral changes of exposed fishes and invertebrates and their prey.

***Birds*:** Unavoidable adverse impacts would take place if unintended releases into the environment and subsequent response activities were to contact birds or their habitats. If a large oil spill occurs and contacts bird habitats, some birds could experience lethal and sublethal impacts from oiling, and birds feeding or resting in the water could be oiled and die. Oil spills and oil-spill cleanup activities could also affect the food sources for bird species. Depending on the time of year, large oil spills could decrease the nesting success of species that concentrate nests in coastal environments due to direct impacts of the spill and also disruption from oil-spill cleanup activities.

***Marine Mammals*:** Unavoidable adverse impacts from routine OCS oil- and gas-related activities such as seismic surveys, noise, water quality and habitat degradation, helicopter disturbance, vessel collision, and discarded trash and debris could occur. Accidental vessel strikes could be lethal to individuals. Depending on the population status, these unavoidable adverse impacts could lead to irreversible losses or reduced viability of the species (**Chapter 4.19.2.1**). A large oil spill would temporarily degrade habitat if spilled oil, dispersant chemicals, or emulsions of dispersed oil droplets and dispersant chemicals contact free-ranging pods or calving grounds.

***Sea Turtles*:** Unavoidable adverse impacts from routine OCS oil- and gas-related activities could occur from seismic surveys, water quality and habitat degradation, helicopter disturbance, vessel collision, and discarded trash and debris. An oil spill could temporarily degrade habitat if spilled oil, dispersant chemicals, or emulsions of dispersed oil droplets and dispersant chemicals contact free-ranging individuals or groups, calving grounds, or nesting sites.

Threatened and Endangered Species: Because a proposed OCS oil and gas lease sale does not in and of itself make any irreversible or irretrievable commitment of resources that would foreclose the development or implementation of any reasonable and prudent measures to comply with the Endangered Species Act, BOEM may proceed with publication of this Programmatic EIS and finalize a decision among these alternatives even if consultation is not complete, as described in Section 7(d) of the ESA (also refer to **Appendix A.7**). Unavoidable loss of individuals that are ESA-listed species may occur from an accidental vessel strike or after a large oil spill from the acute impact of being oiled or the chronic impact of oil having eliminated, reduced, or rendered suboptimal the food species upon which they were dependent (**Chapter 4.19.2.1**).

***Commercial Fisheries and Recreational Fishing*:** Unavoidable adverse impacts from routine operations are loss of open ocean or bottom areas desired for fishing by the presence or construction of OCS oil- and gas-related facilities and pipelines. Loss of gear could occur from bottom obstructions around platforms and subsea production systems. The removal of an offshore structure at the end of its life cycle could have negative impacts on recreational fishing proportional to how important that structure was as a target for recreational fishers. If a large oil spill occurs, it is unlikely that fishermen would want, or be permitted, to harvest fish in the area of an oil spill, as spilled oil could coat or contaminate commercial fish species, rendering them unmarketable.

***Recreational Resources*:** Unavoidable adverse impacts from construction and routine operations may result in the accidental loss overboard of equipment or debris that may eventually come ashore on frequented recreational beaches. A large oil spill could make landfall on recreational resources, leading to local or regional economic losses and stigma effects, causing potential users to avoid the area after acute impacts have been removed. Some recreational resources become temporarily soiled by weathered crude oil, and small surface residue balls (also called tarballs) may come ashore long after stranded oil has been cleaned from shoreline areas. Impacts on recreational resources from a large oil spill may, at the time, seem irreversible, but the impacts are generally temporary. Beaches fouled by a large oil spill would be temporarily unavailable to the people who would otherwise frequent them, but only during the period between landfall and cleanup of the oil, followed by an indefinite lag period during which stigma effects recede from public consciousness.

***Archaeological Resources*:** Unavoidable adverse impacts from routine OCS oil- and gas-related activities could lead to the loss of unique or significant archaeological resources. It is BOEM's policy to not approve any EP or DOCD plan with known or potential archaeological resources within 500 ft (152 m) of the planned activity or a pipeline application with known or potential archaeological resources within the pipeline corridor or right-of-way (the 200-ft [61-m] corridor in which the pipeline is to be constructed). For decommissioning activities, all known or potential (i.e., sidescan-sonar targets) archaeological resources sitting atop the seafloor, must be investigated before site clearance activities take place. If the presence of archaeological resources is confirmed, exceptions to the site clearance requirements at that location would be considered as described in NTL No. 2019-G05. Complete archaeological data recovery (excavation) would be required if BOEM decided that a permitted activity must take place that would cause an adverse impact to an archaeological resource.

Economic and Social Factors: Unavoidable adverse impacts from routine operations follow trends in supply and demand based on the commodity prices for oil, gas, and refined hydrocarbon products. Declines in oil and gas prices can lead to activity ramp downs by operators until prices rise. Decline in oil and gas activity due to market fluctuations could have negative repercussions to social factors for those families and communities involved in oil- and gas-related businesses. A large oil spill would cause temporary increases in economic activity associated with spill-response activity. An increase in economic activity from the response to a large spill could be offset by temporary work stoppages that are associated with spill-cause investigations and would involve a transfer or displacement of demand to different skill sets. Large spills and subsequent closures could impact the ability to pursue resource exploitation activities related to those areas closed, such as commercial, recreational, and subsistence fishing, as well as the ability to appreciate sites of cultural importance, which could in turn have negative impacts on social factors. Routine operations affected by new regulations that are incremental would not have much effect on the baseline of economic activity; however, temporary work stoppages or the introduction of several new requirements at one time, which are costly to implement, could cause a drop-off of activity as operators adjust to new expectations or use the opportunity to move resources to other basins where they have interests.

4.19 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

Irreversible or irretrievable commitment of resources refers to impacts or losses to resources that cannot be reversed or recovered (e.g., when a species becomes extinct or when wetlands are permanently converted to open water). A lease itself does not approve the irretrievable production of hydrocarbons. All OCS oil- and gas-related activities would require additional BOEM reviews and approvals prior to any "on water" activities that would result in an irreversible or irretrievable commitment of resources. In addition, the Secretary of the Interior retains discretion under the OCSLA to, among others, cancel or suspend plans, activities, and permits at any time, so as to protect the environment (refer to 43 U.S.C. § 1334(a)). Therefore, BOEM does not view an OCS oil and gas lease sale as an irreversible or irretrievable commitment of resources. Nevertheless, at BOEM's discretion, this chapter discloses potential irreversible or irretrievable commitments of resources that could result from any approved OCS oil- and gas-related activities associated with an OCS oil and gas lease sale.

4.19.1 Coastal Communities and Habitats

An irreversible or irretrievable loss of wetlands and associated biological resources could occur if wetlands 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.

4.19.2 Biological Resources

An irreversible loss or degradation of ecological habitat caused by cumulative activity 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.

4.19.2.1 Protected Species

Irreversible loss of individuals that are protected species (marine mammals, sea turtles, protected birds, and fish) could occur from an unintended vessel strike or after a large oil spill from the acute impact of being oiled or the chronic impact of oil having eliminated, reduced, or rendered suboptimal the food species upon which they were dependent. Whether the loss of individuals would lead to a permanent loss of that species that cannot be reversed or recovered would be dependent on the population status/condition of that species at the time of the loss of individuals. It can be difficult or impossible to identify or predict when that threshold is, or would be, reached.

4.19.2.2 Fishes and Invertebrates, Deepwater Benthic Communities and Habitats, Commercial Fisheries, and Recreational Fishing

Irreversible loss of any fish or invertebrate populations (or extinction of any fish or invertebrate species) is not expected.

Irreversible loss of benthic communities and habitats (including ESA-listed corals and designated coral critical habitats) may be caused by unintended large oil spills or unmitigated bottom disturbance. Irreversible loss of commercial fisheries, and recreational fishing, may be caused by structure removals or from unintended large oil spills.

4.19.3 Archaeological Resources

Any loss of discovered or undiscovered archaeological resources on or below the seafloor of the OCS in developed areas would be an irreversible and irretrievable commitment of resources.

4.19.4 Oil and Gas Development

Subsequent development and extraction of hydrocarbons as a result of a proposed action represents an irreversible and irretrievable commitment by the removal and consumption of nonrenewable oil and gas resources.

4.19.5 Loss of Human and Animal Life

Any loss of human and animal life from unpredictable and unexpected acts of man and nature (e.g., unavoidable accidents, accidents caused by human negligence or misinterpretation, human error, and adverse weather conditions) would be an irreversible and irretrievable commitment of resources. Some normal and required operations, such as structure removal, can kill sea life in proximity to explosive charges or by removal of the structure that served as the framework for invertebrates living on it and the fish that lived with it.

4.20 RELATIONSHIP BETWEEN THE SHORT-TERM USE OF MAN'S ENVIRONMENT AND THE MAINTENANCE AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY

The short-term impacts on various components of the environment in the vicinity of the lease sale area are related to long-term impacts and the maintenance and enhancement of long-term productivity.

4.20.1 Short-Term Use

Short term refers to the total duration of oil and gas exploration and production activities. Extraction and consumption of offshore oil and natural gas is a short-term benefit. Depleting a nonrenewable resource now removes these domestic resources from being available for future use.

The specific impacts of an OCS oil and gas lease sale vary in kind, intensity, and duration according to the activities occurring at any given time (**Chapter 3**). Initial activities, such as seismic surveying and exploration drilling, result in short-term, localized impacts. Development drilling and well workovers occur sporadically throughout the life of an OCS oil and gas lease sale but also result in short-term, localized impacts. Activities during the production life of a platform or subsea development may result in chronic impacts over a longer period of time (over 25 years), potentially punctuated by more severe impacts as a result of accidental events or permanent impacts from development. Platform removal is also a short-term activity with localized impacts, including removal of the habitat for encrusting invertebrates and fish living among them and site clearance trawling of the seafloor. Many of the impacts on physical, biological, and socioeconomic resources discussed in **Chapter 4** are considered to be short term (being greatest during the construction, exploration, and early production phases). These impacts would be further reduced by the mitigating measures discussed in **Chapter 2.3**.

The OCS oil and gas development in the GOM has enhanced some recreational and commercial activities. An OCS oil and gas lease sale could increase these incidental benefits by the presence of offshore development. As mineral resources become depleted, platform removals would occur and may result in a decline in these activities, but this could be offset by Rigs-to-Reefs Program.

The short-term exploitation of hydrocarbons for the OCS Oil and Gas Program in the GOM may lead to long-term impacts on biologically sensitive resources and areas if an oil spill occurs. A spill and spill-response activity could temporarily interfere with commercial and recreational fishing, beach use, and tourism in the area where the spill makes landfall and in a wider area based on stigma effects. The proposed leasing may also result in onshore development and population increases that could cause very short-term adverse impacts to local community infrastructure, particularly in areas of low population and minimal existing industrial infrastructure.

4.20.2 Relationship to Long-Term Productivity

Long-term refers to an indefinite period beyond the termination of oil and gas production. Over a period of time after peak oil production has occurred in the GOM, a gradual easing of the specific impacts caused by oil and gas exploration and production would occur as the productive reservoirs in the GOM have been discovered, produced, and become depleted.

After the completion of oil and gas production, a gradual ramp-down to economic conditions without OCS oil- and gas-related activity would be experienced, while the marine environment is generally expected to remain at or return to its normal long-term productivity levels. Primary productivity varies in the GOM from eutrophic coastal and estuarine waters to the oligotrophic deep ocean. Production on the shelf off the Mississippi River and within estuaries is approximately 300 grams carbon per m^2/yr. On the shelf, at a distance from the Mississippi and Atchafalaya Rivers or where upwelling is sparse, production is approximately 200 grams carbon per m^2/yr. Production is much lower in the surface waters over the deep GOM basin. Therefore, primary production in the GOM is dominated by processes along the margins of the GOM (Turner and Rabalais 2019). The interaction of numerous physical and chemical processes makes it difficult to understand the control of primary production, tease out trends, and relate any species or habitat responses to such production (Lohrenz et al. 1999). A more thorough discussion of primary production in the Gulf of Mexico is available in BOEM's *Biological Environmental Background Report for the Gulf of Mexico OCS Region* (BOEM 2021b).

A major variable in the long-term productivity of the GOM environment is climate change. The 2024-2029 National OCS Oil and Gas Program Programmatic EIS (BOEM 2023b) analyzes the potential contributions to climate change from a proposed leasing program, as well as substitute sources of energy in the absence of new OCS leasing. That analysis is hereby incorporated by reference. In the 2024-2029 National Oil and Gas Program Programmatic EIS analysis, GHGs were identified as one of the key drivers of climate change, and estimates of GHG emissions and their social costs from a National OCS Oil and Gas Program are presented. Climate change causes planet-wide physical, chemical, and biological changes that substantially affect the world's oceans, lands, and atmosphere. Observed harms of climate change that can affect long-term environmental productivity were described by Gevondyan et al. (2023) and include (1) effects of sea-level rise on shoreline degradation and erosion, (2) damages caused by increased severe weather effects, (3) ocean acidification effects, (4) impacts on the health of the environment, (5) impacts on the formation of hypoxic zones, (6) effects on marine life and fisheries, and (7) damages to historically significant heritage sites (Gevondyan et al. 2023). This Programmatic EIS includes specific descriptions of the impacts from climate change on the resources of the GOM (**Chapters 4.1-4.17**) and includes GHG emissions estimates and their social costs from a single OCS oil and gas lease sale in the GOM (**Appendix H**).

Major ecosystem services (i.e., positive benefits provided by ecosystems to humans) managed within the context of the Gulf of Mexico large marine ecosystem include recreational and commercial fisheries, oil and gas production, recreational resources, and potential future renewable energy development (BOEM 2021b). To help sustain the long-term productivity of the Gulf of Mexico ecosystem, BOEM continues to improve the knowledge and mitigation practices used in offshore development to enhance the safe and environmentally responsible development of OCS oil and gas resources. The OCS Oil and Gas Program also provides for structures to be used as site-specific artificial reefs and fish-attracting devices for the benefit of commercial and recreational fishers, sport divers, and spear fishers.

APPENDIX A

CONSULTATION AND COORDINATION

A CONSULTATION AND COORDINATION

A.1 INTRODUCTION

The Bureau of Ocean Energy Management (BOEM) is conducting consultations and other activities to comply with the following laws, including but not limited to, the development of consistency determinations (CDs) under the Coastal Zone Management Act (CZMA), consultation under the Endangered Species Act (ESA) for potential impacts to listed species or designated critical habitat, completion of an Essential Fish Habitat assessment pursuant to the Magnuson-Stevens Fishery Conservation and Management Act, and a request for comments and consultation with federally recognized Indian Tribes pursuant to the National Historic Preservation Act and Executive Order 13175. Pursuant to the National Environmental Policy Act (NEPA), BOEM has conducted public involvement activities during review of this Draft Programmatic Environmental Impact Statement (EIS). This chapter describes the processes with which BOEM worked with other Federal and State agencies, Tribal governments, and the public during the development of this Programmatic EIS.

A.2 COASTAL ZONE MANAGEMENT ACT

BOEM performs a consistency review pursuant to the CZMA, and CDs are prepared for each coastal State along the Gulf of Mexico with a federally approved Coastal Management Program (CMP) prior to each oil and gas lease sale. To prepare the CDs prior to each GOM oil and gas lease sale, BOEM reviews each State's federally approved Coastal Management Plan and analyzes the potential impacts as described in this Programmatic EIS; new information; and applicable studies as they pertain to the enforceable policies of each CMP. The CZMA requires that Federal actions that have reasonably foreseeable coastal effects (i.e., effects to any coastal use or resource of the coastal zone) be "consistent to the maximum extent practicable" with relevant enforceable policies or guidelines of the State's federally approved coastal management program (15 CFR part 930 subpart C).

Based on these and other analyses, BOEM's Gulf of Mexico Regional Supervisor for the Office of Environment makes an assessment of consistency, which is then sent to the States of Texas, Louisiana, Mississippi, Alabama, and Florida for GOM oil and gas lease sales. If the State concurs, BOEM proceeds with the lease sale. A State's concurrence may be presumed when a State does not provide a response within the 60-day review period. A State may request an extension of time to review the CD within the 60-day period, which the Federal agency shall approve for an extension of 15 days or less. If a State objects, it must do the following under the CZMA:

(1) indicate how BOEM's prelease proposal is inconsistent with the State's federally approved CMP and suggest alternative measures to bring BOEM's proposal into consistency with the State's CMP; or

(2) describe the need for additional information that would allow a determination of consistency. In the event of an objection, the Federal and State agencies should use the remaining portion of the 90-day review period to attempt to resolve their differences (15 CFR § 930.43(b)).

At the end of the 90-day review period, the Federal agency shall not proceed with the activity over a State agency's objection unless the Federal agency concludes that, under the "consistent to the maximum extent practicable" standard described in 15 CFR § 930.32, consistency with the enforceable policies of the CMP is prohibited by existing law applicable to the Federal agency, and the Federal agency has clearly described, in writing, to the CZMA State agency the legal impediments to full consistency; or the Federal agency has concluded that its proposed action is fully consistent with the enforceable policies of the CMP, though the State agency objects. Unlike the consistency process for specific Outer Continental Shelf (OCS) plans and permits, there is no procedure for administrative appeal to the Secretary of Commerce for a Federal CD for prelease activities. In the event that there is a serious disagreement between BOEM and a State, either agency may request mediation. Mediation is voluntary, and the Secretary of Commerce would serve as the mediator. Whether there is mediation or not, the final CD is made by DOI, and it is the final administrative action for the prelease consistency process. Each Gulf Coast State's CMP is described in **Appendix G**.

A.3 Endangered Species Act

The Endangered Species Act of 1973 (ESA, 16 U.S.C. §§ 1531 *et seq.*), as amended, establishes a national policy designed to protect and conserve threatened and endangered species and the ecosystems upon which they depend. Section 7(a) (2) of the ESA requires each Federal agency to ensure that any action that they authorize, fund, or carry out is not likely to jeopardize the continued existence of a listed species or result in the adverse modification of designated critical habitat.

On April 20, 2018, FWS issued its 10-year Biological Opinion (BiOp) for BOEM and the Bureau of Safety and Environmental Enforcement's (BSEE's) OCS oil- and gas-related activities in the GOM (including holding lease sales), which does not include any terms and conditions for the protection of endangered species that the Bureaus, lessees, or operators must implement (FWS 2018). The FWS BiOp stated that any future consultations may be informal dependent upon the likelihood of take.

On March 13, 2020, NMFS issued a BiOp and related terms and conditions and reasonable and prudent measures for future approvals of OCS oil- and gas-related activities (including lease sales) in the GOM for the protection of species listed as endangered or threatened under the ESA and under NMFS' jurisdiction (NMFS 2020). The NMFS' programmatic BiOp addresses any future lease sales and any future approvals issued by BOEM and BSEE, under both existing and future OCS oil and gas leases in the GOM, over a 10-year period. Applicable terms and conditions and reasonable and prudent measures from NMFS' BiOp could be included in an oil and gas lease sale in the Protected Species Stipulation (as described in **Chapter 2.2.2 and Appendix F**); other specific Conditions of Approval (COA) would also be applied to post-lease approvals (e.g., permits and plans). Any future BiOp amendments or COAs shall be a requirement and binding on subsequent actions. The NMFS BiOp and supporting documents can be found online at https://repository.library.noaa.gov/view/noaa/23738.

The NMFS BiOp made a jeopardy determination concerning GOM Bryde's[1] whales (now Rice's whale) due to the potential for vessel strikes for service vessels transiting the GOM Rice's whale area, which is largely in the Eastern Planning Area (EPA) of the Gulf of Mexico and under presidential withdrawal. BOEM reviewed this analysis and found that the activities and effects from an oil and gas lease sale are not reasonably foreseeable as a result of a proposed action since service vessels expected to service leases issued as a result of a lease sale are likely to use ports closer to the Western Planning Area and Central Planning Area (WPA and CPA, respectively), and are unlikely to transit across greater distances through the withdrawal area to get to the leases. Nevertheless, BOEM notified NMFS in April 2021 that it was formally accepting the reasonable and prudent alternative for the GOM Rice's whale, and on May 7, 2021, NMFS accepted BOEM's approach and stated it would not need to further amend its BiOp to reflect that change. The NMFS had previously updated the 2020 BiOp and appendices in April 2021 to reflect other changes (the amended appendices can be found online at https://repository.library.noaa.gov/view/noaa/29355). In accordance with 50 CFR §§ 402.2 and 402.14(g)(8) and the 1998 consultation handbook, BOEM and BSEE are implementing the reasonable and prudent alternative to comply with Section 7(a) of the ESA and ensure that there is no jeopardy for the Rice's whale. Therefore, a decision to hold a lease sale is not expected to reduce appreciably the likelihood of both survival and recovery of the GOM Rice's whales, and in the unlikely event that post-lease activities are proposed that could impact the GOM Rice's whale, both BSEE and BOEM have the discretion to require additional mitigations at that time. The impacts to ESA-listed species from an oil and gas lease sale are addressed in **Chapter 4** of this Programmatic EIS.

BOEM petitioned NMFS for rulemaking under the Marine Mammal Protection Act (MMPA, 16 U.S.C. §§ 1361 *et seq.*) to assist industry in obtaining incidental take coverage for marine mammals due to oil and gas deep-penetration seismic G&G surveys in the Gulf of Mexico. On January 19, 2021, NMFS published in the *Federal Register* (86 FR 5322) its final "Incidental Take Regulation on Geophysical Surveys Related to Oil and Gas Activities in the Gulf of Mexico" as a result of the petition; the rule took effect on April 19, 2021. In April 2021, NMFS amended the Incidental Take Statement associated with the 2020 BiOp (which also served as the intra-service consultation for the rule). The amendment updated Appendices A and C to align with the regulation and updated the COAs developed since the release of the programmatic BiOp. The Appendices and COAs may be imposed on lessees and operators through compliance reviews associated with the Programmatic BiOp when lessees or operators submit requests for plans or permits, or through Letters of Authorization issued under the rule. Any additional mitigations applied by industry through the rule would only be expected to further reduce impacts addressed in this Programmatic EIS. As the final incidental take regulation took effect on April 19, 2021, survey operators are now able to apply for Letters of Authorization. A draft revision to this regulation that corrects some calculation errors and therefore adjusts taking allowable under the regulations was published on January 5, 2023 (88 FR 916). There are no changes

[1] On August 23, 2021, the NMFS published a direct final rule in the *Federal Register* (86 FR 47022): Endangered and Threatened Wildlife and Plants; Technical Corrections for the Bryde's Whale (Gulf of Mexico Subspecies). The NMFS revises the common name to the Rice's whale, the scientific name to *Balaenoptera ricei*, and the description of the listed entity to the entire species. The changes to the taxonomic classification and nomenclature do not affect the species' listing status under the ESA or any protections and requirements arising from its listing. This rule became effective on October 22, 2021.

to the specified activities or the specified geographical region in which those activities would be conducted, nor to the original 5-year period of effectiveness. The comment period closed on February 6, 2023.

On October 25, 2022, BOEM and BSEE requested reinitiation of the consultation with NMFS in light of an upcoming oil-spill risk analysis and to incorporate certain previously developed and implemented mitigations for Rice's whales. For now, the Bureaus will continue to implement the existing 2020 BiOp as amended, including to all Reasonable and Prudent Measures and Terms and Conditions. On August 19, 2024, the United States District Court for the District of Maryland remanded the 2020 NMFS BiOp addressing the effects of oil and gas development on the Rice's Whale, and subsequently deferred vacatur of the Opinion until May of 2024 as NMFS completes a new BiOp. The 2020 BiOp remains valid during the pendency of NMFS work on remand, but NMFS has explained that it must undertake significant new analysis during that remand, including, potentially, the development of new reasonable and prudent alternatives. See Sierra Club v. NMFS, 8:20-cv-3060, ECF No. 211-2 paragraphs 7-9 (Sept. 16, 2024). Insofar as NMFS completes its remand before publication of the final EIS, BOEM anticipates that the EIS will revisit significant components of its analysis of the program's effects on Rice's Whale to account for the new BiOp and underlying scientific, analytical, and observational advances.

Based on the most recent and best available information at the time, BOEM and BSEE will continue to closely evaluate and assess risks to listed species and designated critical habitat in upcoming environmental compliance documentation under NEPA and other statutes. Refer to **Appendix E** for copies of the consultation letters.

A.4 MAGNUSON-STEVENS FISHERY CONSERVATION AND MANAGEMENT ACT

Pursuant to Section 305(b) of the Magnuson-Stevens Fishery Conservation and Management Act, Federal agencies are required to consult with NMFS on any action that may result in adverse effects to essential fish habitat (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 oil- and gas-related activities authorized by BOEM may result in adverse effects to EFH and therefore require EFH consultation.

BOEM prepared an EFH Assessment technical report that describes the OCS proposed activities, analyzes the effects of the proposed activities on EFH, and identifies proposed mitigating measures (BOEM 2022). The EFH Assessment was sent to NMFS on May 25,2022, with a letter requesting formal consultation. The NMFS responded to BOEM's consultation request with conservation recommendations on July 29, 2022. The regional programmatic EFH consultation concluded on September 27, 2022, when BOEM and BSEE responded via letter to NMFS' conservation recommendations. This consultation covers reasonably foreseeable oil- and gas-related activities on the Gulf of Mexico OCS. Reasonably foreseeable activities include proposed lease sales and activities related to exploration, development, production, and decommissioning, including, but not limited to, geological and geophysical activities, drilling, construction, support, removal, and site clearance operations. The agreed upon conservation recommendations contain provisions for initiating supplemental discussions should it be determined that site-specific or activity-specific consultation is necessary. Refer to **Appendix E** for the regional programmatic EFH consultation letters.

A.5 NATIONAL MARINE SANCTUARIES ACT 304(D) CONSULTATION

The National Marine Sanctuaries Act (16 U.S.C. § 1431 *et seq.*; NMSA) authorizes the Secretary of Commerce to designate and manage areas of the marine environment with special national significance. Section 304(d) of the NMSA requires Federal agencies to consult with the Office of National Marine Sanctuaries (ONMS) whenever their proposed actions are likely to destroy, cause the loss of, or injure a sanctuary resource and/or may adversely affect the protected resources within a sanctuary's boundaries. The purpose of NMSA consultation is to protect sanctuary resources by requiring Federal agencies to consider alternatives to proposed actions that might otherwise destroy, cause the loss of, or injure these resources. For the activities analyzed in this Programmatic EIS, BOEM initiated Section 304(d) consultation with the Flower Garden Banks National Marine Sanctuary (FGBNMS). BOEM is currently in consultation with ONMS and FGBNMS on programmatic OCS oil- and gas-related activities in the GOM. In accordance with the requirements set forth in Section 304(d), individual activity-specific consultations will be initiated for proposed activities likely to destroy, cause the loss of, or injure a sanctuary resource and/or may adversely affect the protected resources within a sanctuary's boundaries until the programmatic consultation is complete.

A.6 NATIONAL HISTORIC PRESERVATION ACT

In accordance with the National Historic Preservation Act (54 U.S.C. §§ 300101 *et seq.*), Federal agencies are required to consider the effects of their undertakings on historic properties. The implementing regulations for Section 106 of the National Historic Preservation Act, issued by the Advisory Council on Historic Preservation (36 CFR part 800), specify the required review process. In accordance with 36 CFR § 800.8(c), BOEM intends to use the NEPA substitution process and documentation for preparing a prelease EIS and Record of Decision or a post-lease environmental assessment and Finding of No Significant Impact to comply with Section 106 of the National Historic Preservation Act in lieu of 36 CFR §§ 800.3-800.6. Because of the extensive geographic area analyzed in this Programmatic EIS and because identification of historic properties will take place after leases are issued, BOEM will complete its Section 106 review process once BOEM has performed the necessary site-specific analysis of post-lease activities prior to issuing a permit or approving these activities. Additional consultations with the Advisory Council on Historic Places, State Historic Preservation Offices, federally recognized Indian Tribes, and other consulting parties may take place at that time, if appropriate. Refer to Chapter 3.18 of the *Gulf of Mexico OCS Regulatory Framework* technical report for more information on this review process.

BOEM conducts Section 106 of the National Historic Preservation Act consultations with State Historic Preservation Offices for site-specific permitted activities with Areas of Potential Effect in State waters. No recent consultations have identified historic properties with the potential to be adversely affected by those activities.

A.7 GOVERNMENT-TO-GOVERNMENT TRIBAL CONSULTATION

In accordance with Executive Order 13175, “Consultation and Coordination with Indian Tribal Governments,” Federal agencies are required to establish regular and meaningful consultation and collaboration with Tribal officials in the development of Federal policies that have Tribal implications to strengthen the United States’ government-to-government relationships with Indian Tribes and to reduce the imposition of unfunded mandates upon Indian Tribes. On October 2, 2023, BOEM sent a formal letter to federally recognized Indian Tribes notifying them of the development of this Programmatic EIS. That letter was addressed to each of the Gulf Coast State-affiliated Tribes, including the Absentee Shawnee Tribe of Indians, Alabama-Coushatta Tribe of Texas, Alabama-Coushatta Tribe of Texas, Alabama-Quassarte Tribal Town, Apache Tribe of Oklahoma, Caddo Nation of Oklahoma, Cheyenne and Arapaho Tribes of Oklahoma, Chitimacha Tribe of Louisiana, Choctaw Nation of Oklahoma, Comanche Nation of Oklahoma, Coushatta Tribe of Louisiana, Eastern Shawnee Tribe of Oklahoma, Jena Band of Choctaw Indians, Kiowa Indian Tribe of Oklahoma, Mescalero Apache Tribe, Miccosukee Tribe of Indians of Florida, Mississippi Band of Choctaw Indians, Muscogee (Creek) Nation, Poarch Band of Creek Indians, Seminole Tribe of Florida, Seminole Nation of Oklahoma, Shawnee Tribe, Southern Ute Indian Tribe, Thlopthlocco Tribal Town, Tonkawa Tribe, and Tunica-Biloxi Indian Tribe of Louisiana. Refer to **Appendix E** for an example of the letter that was sent to the Tribes. The letter was intended to be the first step of a long-term and broad consultation effort between BOEM and the Gulf-area Tribes, inclusive of all BOEM activities that may occur under the Draft Proposed Program, as well as ongoing activities.

In response to these communications, the Southern Ute Indian Tribe acknowledged receipt and said they would reach out if they wanted to consult on this matter (Shipps 2023). The Seminole Tribe of Florida responded and noted the action was outside of their area of interest but would still like to continue consultation on this matter (Mueller 2023). The Kiowa Tribe responded and requested additional information and expressed interest in becoming a cooperating agency as part of the EIS process (Kelley 2023). A meeting with the acting regional tribal liaison and a representative from the Kiowa Tribe was held on December 12, 2023, to provide more information regarding this Programmatic EIS. That meeting addressed the tribe’s needs and they decided not to pursue being a cooperating agency at that time. No further correspondence has been received from the Kiowa Tribe to date. The Choctaw Nation of Oklahoma responded and noted that this action lies within their area of interest where they have a number of cultural and sacred sites along the Gulf of Mexico and requested to continue consultation on this matter (Bilyeu 2023).

BOEM continues to consult with Tribes on GOM oil- and gas-related activities and other BOEM-authorized activities proposed on the Gulf of Mexico OCS and will update this summary as additional efforts are conducted.

BOEM has also analyzed environmental justice issues for minority and low-income populations, which is broadly applicable to federally recognized Indian Tribes. Further information on that analysis can be found in **Chapter 4.16** of this Programmatic EIS.

A.8 LEASE SALE PROCESS AND THE NATIONAL ENVIRONMENTAL POLICY ACT

A.8.1 Development of the Proposed Action

The proposed Federal action is a GOM oil and gas lease sale. The is Programmatic EIS analyzes a representative Gulf of Mexico OCS oil and gas lease sale. This Programmatic EIS is expected to be used to inform the decision for the first GOM oil and gas lease sale proposed in the 2024-2029 National OCS Oil and Gas Program, to be used and supplemented as appropriate for decisions on future proposed GOM lease sales, to be used for tiering purposes for associated site- and activity-specific OCS oil- and gas-related activity approvals, and/or to help inform extraordinary circumstance reviews to ensure categorical exclusions are used appropriately. BOEM conducted early coordination with appropriate Federal and State agencies, Tribal governments, and other concerned parties to discuss and coordinate BOEM's prelease process for GOM oil and gas lease sales and this Programmatic EIS.

A.8.1.1 Call for Information and Area ID Memorandum

Pursuant to the Outer Continental Shelf Lands Act of 1953, as amended (OCSLA), BOEM published a Call for Information (Call) to request and gather information to determine the Area ID for each lease sale. The Call was published in the *Federal Register* (83 FR 66300) on October 2, 2023. The comment period for the Call closed on November 1, 2023. BOEM received 10 comments in response to the Call; the substantive comments are summarized below.

Earthjustice, Natural Resources Defense Council, Sierra Club, Friends of the Earth US, Oceana, Zero Hour, Mystic Aquarium, Ocean Defense Initiative, Chispa Texas, and League of Conservation Voters

- BOEM should minimize oil and gas leasing in the GOM and limit the areas available for leasing.
- Based on the data, oil and gas exploration should be limited in the Rice's whale area, FGBNMS, Significant Sediment Resource Areas, topographic and sensitive biological areas, and Wind Energy Areas.

American Petroleum Institute, Independent Petroleum Association of America, Louisiana Mid-Continent Oil and Gas Association, and EnerGeo Alliance

- Offer maximum amount of acreage.
- No targeted leasing.
- Disappointed in curtailment of lease sales.
- Notes Program gap.
- Disagrees with net-zero analysis and methodology.

Cantium

- Requests maximum acreage offered.
- Prioritize oil and gas over wind energy areas.
- More oil and gas lease sales per Program.

BP America Inc.

- Offer maximum acreage, maximize Tier 1 nominations.
- Notes legal requirements (Inflation Reduction Act).
- Consider new lease award procedures – offering the second highest bidder the lease if the highest bidder does not pay the full amount required to award the lease.
- Wants explicit language in the Proposed Notice of Sale of BOEM’s oil and gas lease sale intent.

Sierra Club Lone Star Chapter

- Minimize oil and gas leasing in the GOM.
- Limit areas available for leasing.
- Noted development impact on communities, marine ecosystems, and climate change.
- Noted environmental impact due to production and noise pollution from surveying, exploration and vessel traffic.
- Limit exploration in the Rice's whale area, FGBNMS, Significant Sediment Resource Areas, topographic and sensitive biological , and Wind Energy Areas.
- Supports no drilling option in the Programmatic EIS.
- Improve restriction and mitigating measures.

Shell Offshore Inc.

- Nominate all blocks in GOM Program area.
- Refers to the Inflation Reduction Act and encourages following the 60,000-acre minimum offering requirement.
- Asks for at least one oil and gas lease sale in the GOM per year to better cover wind leases.
- Increase primary term to 10 years on some blocks to make them more attractive opportunities.

- Encourage multiple uses on the block, such as carbon capture and sequestration.
- Encourages BOEM to follow legally required process to designate endangered species and their habitats.

Offshore Operators Committee

- Offer a vast majority of the Western and Central Planning Areas.
- Continue to include the limited portion of the Eastern Planning Area.

National Ocean Industries Association

- BOEM should offer all available unleased acreage in the GOM.
- Terminate regressive energy policies and return to business as usual.
- BOEM is asking for too much information be given in the Call and that information would be used nefariously.

Chevron

- BOEM should offer all available blocks for each GOM oil and gas lease sale.
- Touts Chevron's operating history of cooperation for working with other stakeholders and believes some areas should not be separated by use but shared.
- Supports multiuse blocks for carbon capture and sequestration.
- Nominate all blocks.

Private Citizen

- Wants the oil and gas lease sale cancelled for environmental reasons.

Using information provided in response to the Call and from scoping comments (summarized below) received for the GOM Oil and Gas Programmatic EIS, BOEM developed an Area Identification (Area ID) recommendation memorandum. The Area ID is an administrative prelease step that describes the geographic area for environmental analysis and consideration for leasing. All of this information was used to develop a proposed action and a reasonable range of alternatives for the GOM Oil and Gas Programmatic EIS. On March 15, 2024, the Area ID decision was published (89 FR 22444) for all proposed oil and gas lease sales from 2024 through 2029. The Area ID memo recommended keeping the area of the GOM comprised of all unleased blocks in the WPA, CPA, and EPA not subject to Congressional moratorium, pursuant to the Gulf of Mexico Energy Security Act of 2006 (which is now under Presidential withdrawal), for environmental analysis when considering future GOM oil and gas lease sales.

A.8.2 Development of the Draft Programmatic EIS

A.8.2.1 Internal Scoping

Internal scoping provides BOEM an opportunity to update BOEM's Gulf of Mexico OCS Region's environmental and socioeconomic information base. The internal scoping process for the Draft Programmatic EIS yielded the following:

- the GOM Oil and Gas SID, which is incorporated by reference, was created and publicly released to reduce the amount of technical information contained in an EIS;
- all subject-matter experts reevaluated the cause and effect relationships between OCS oil- and gas-related activities and their resources;
- several resources have been reorganized or renamed since the GOM Lease Sales 259 and 261 Supplemental EIS to increase document readability and reduce redundancies:
  - Coastal Communities and Habitats combines the Estuarine Systems (Wetlands and Seagrasses/Submerged Vegetation) and Coastal Barrier Beaches and Associated Dunes chapters;
  - Benthic Communities and Habitats combines the Deepwater Benthic Communities, Live Bottoms (Topographic Features and Pinnacles and Low-Relief Features), and Protected Corals chapters;
  - Pelagic Communities and Habitats includes and expands upon the *Sargassum* and Associated Communities chapter;
  - Protected Species (Marine Mammals, Sea Turtles, Protected Birds, and Protected Corals) descriptions have been included in their respective chapters and not considered in their own separate analyses; and
  - after careful consideration, the beach mice were eliminated from further analysis as species of special concern as they are not likely to be impacted by a proposed action. As they only inhabit coastal sand dunes, their habitat is generally removed from the associated activities of the proposed action. They are generally considered part of the coastal communities and habitats analysis. BOEM reserves the right to add them at a future date as designations and overall environmental indicators may change following consultations with, and concerns of, the U.S. Fish and Wildlife Service.

A.8.2.2 Notice of Intent to Prepare an Environmental Impact Statement

Scoping for the Draft Programmatic EIS was conducted in accordance with the Council on Environmental Quality's regulations for implementing NEPA. BOEM published a Notice of Intent to Prepare an Environmental Impact Statement (NOI) on October 2, 2023, in the *Federal Register*

(88 FR 67803). The NOI announced the scoping process that BOEM will use to identify significant issues and potential alternatives for consideration in this Programmatic EIS. The comment period for the NOI closed on November 1, 2023. BOEM also held two virtual public scoping meetings on October 17, 2023, at 6 p.m. CDT and on October 19, 2023, at 1 p.m. CDT. BOEM received 21 total comments in response to the NOI (4 by email through Government-to-Government Consultation, 13 on the NOI [Docket BOEM-2023-0046], and 4 at the public meetings). The substantive comments are summarized below by commenter. For a summary of responses by Indian Tribal Governments, refer to **Chapter A.7** above.

Noble Corporation

- Stated a preference for Alternative B.
- Interested in seeing offshore wind evolve in support of Carbon Capture Utilization and Storage (CCUS) growth and expansion.

Private Citizen

- Concerned for the impacts of the proposed action on air quality, water quality, protected species (protected corals and Rice's whale), vulnerable coastal communities, space use with other ocean users (i.e., commercial fishing and aquaculture industries), and contribution to greenhouse gas.
- Stated preference for Alternative D due to Inflation Reduction Act requirements to also issue offshore wind leases.

Private Citizen

- Supports BOEM's efforts in preparing an EIS.
- Requests consideration of the climate and ecological impacts from leasing in the Gulf of Mexico by adopting the strongest possible protections.

Occidental Petroleum Corporation

- Supports BOEM's efforts in preparing an EIS.
- Requests consideration of the climate and ecological impacts from leasing in the Gulf of Mexico by adopting the strongest possible protections.

American Petroleum Institute, National Ocean Industries Association, Independent Petroleum Association of America, Louisiana Mid-Continent Oil and Gas Association, Offshore Operators Committee, and EnerGeo Alliance

- Support regionwide leasing under Alternative B and preparing a streamlined EIS.
- BOEM cannot use the NEPA process to delay the lease sale.

- Alternative A should be rejected as not meeting the purpose and need.
- Support analysis of climate change, but not the social cost of greenhouse gas.
- Do not support mitigations for Rice's whale critical habitat and provided an analysis of current information related to Rice's whale critical habitat.

Surfrider Foundation

- Concerned for the effects of climate change on the Texas coast and the impacts resulting from oil spills, seismic surveys, increased ship traffic, increased air and water pollution on environmental justice communities, commercial fishing, and recreation and tourism industries.
- Requests that BOEM do a cumulative analysis and include protections for the Rice's whale.

Ocean Conservancy

- Concerned for climate change, oil spill, and environmental impacts.
- Requests that BOEM consider a full suite of mitigating measures.
- BOEM's analysis of the No Action Alternative must be rigorous.
- BOEM must carefully consider the ramifications of Section 50265 of the Inflation Reduction Act.
- The Programmatic EIS should take a hard look at potential environmental justice impacts.
- BOEM should establish stringent fitness to bid/fitness to operate requirements.
- Revise regulations' policy and guidance governing methane emissions from OCS operations.
- Establish more stringent standards for decommissioning.
- Increase minimum bid requirements.

Private Citizen

- Supports Alternative D.

Earthjustice

- Requests BOEM meaningfully assess:
- Greenhouse gas emissions and impacts to climate change.
- Impacts to Rice's whale from the Proposed Action, oil spills, and vessel strikes.

- Direct, indirect, and cumulative impacts of oil spills and OCS oil- and gas-related activities.
- Impacts to air quality, noise, increased vessel traffic, orphaned wells and pipelines, and multiple uses.
- Mitigating measures that reduce impacts to Rice’s whale from noise vessel traffic and habitat disturbance, and other measures to avoid or minimize impacts to the environment.
- Requests that BOEM properly define the purpose and need and thoroughly evaluate all alternatives, consider more protective alternatives that incorporate geographic exclusions, mitigating measures, and a climate screen; consider an alternative that excludes Rice’s whale habitat with a 10-kilometer (197-mile) or greater buffer and establishes protective mitigating measures; and consider an alternative excluding additional environmentally sensitive areas from leasing.
- Supports inclusion of Alternatives C and D in the Programmatic EIS, which excludes whole and partial blocks within the full range of Rice’s whale habitat.

National Marine Fisheries Service, Southeast Regional Office

- Accepts invitation for Cooperating Agency status.
- Supports the selection of an alternative that would best avoid conflicts with NOAA’s trust resources (e.g., Rice’s whale critical habitat, FGBNMS areas’ sensitive topographic features, etc.).
- Identified several areas to be analyzed in the Programmatic EIS related to their trust resources (e.g., entanglement risk, vessel strikes, acoustic pollution, fishing industries, socioeconomic impacts, etc.).
- Suggests use of marine spatial planning modelling to minimize multiple use issues.
- Provided information related to threatened or endangered species.
- Listed several areas of special expertise: Endangered Species Act; Magnuson-Stevens Fisheries Conservation and Management Act; Fish and Wildlife Coordination Act; Marine Mammal Protection Act; and NEPA.

National Park Service

- Requests Cooperating Agency status due to special expertise regarding the resources and values of the National Park System where the National Park Service (NPS) has management jurisdiction.
- Requests that BOEM consider a no-leasing area within 15 nautical miles (nmi) (17 miles [mi]; 27 kilometers [km]) of the Gulf Islands National Seashore in the GOM.

Center for Biological Diversity

- Requests that BOEM cancel all oil and gas lease sales in the 5-Year OCS Oil and Gas Program due to oil spill and climate change concern.
- Requests that, under any oil and gas lease sale alternative, Rice's whale habitat be excluded.

Environment America

- Opposes new leasing due pollution, climate change, Rice's whale, and environmental and visual impacts.
- Supports a transition to renewable energy.

Surfrider Foundation

- Opposes new leasing due to pollution, climate change, Rice's whale, and environmental and visual impacts.
- Supports Alternative A
- Requests an analysis of impacts to human communities, the environment, and other ocean users; and address life-cycle greenhouse gas emission issues.
- Notes that the negative impacts of oil and gas leasing outweighs the benefits of wind leasing and suggests no leasing at all.

Sierra Club, Texas Chapter

- Supports Alternative A.
- Notes that the negative impacts of oil and gas leasing outweighs the benefits of wind leasing and suggests no leasing at all.
- Requests analysis of downstream refining of oil and gas, protection of ESA-listed species, FGBNMS, and all GOM wildlife.

A.8.2.3 Cooperating Agencies

Pursuant to 43 CFR § 46.225, BOEM must invite eligible government entities to participate as cooperating agencies when developing an EIS in accordance with the requirements of NEPA and CEQ regulations. BOEM must also consider any requests by eligible government entities to participate as a cooperating agency with respect to a particular EIS and must either accept or deny such requests. As defined by CEQ regulations (40 CFR § 1501.8 as of April 2024), a cooperating agency may be any Federal or non-Federal agency that has jurisdiction by law or special expertise with respect to environmental impacts resulting from a proposed activity.

As part of BOEM's Notice of Intent for the Draft Programmatic EIS, BOEM invited other Federal agencies and Tribes to consider becoming Cooperating Agencies in the preparation of this Programmatic EIS. For details on this invitation, refer to BOEM's website at https://www.boem.gov/environment/environmental-assessment/gulf-mexico-regional-ocs-oil-and-gas-programmatic. Even if a governmental entity is not a Cooperating Agency, it will have opportunities to provide information and comments to BOEM during the public input stages of the NEPA process.

Kiowa Tribe

The Kiowa Tribe responded and requested additional information and expressed interest in becoming a cooperating agency as part of the EIS process (Kelley 2023). A meeting with the acting regional Tribal liaison and a representative from the Kiowa Tribe was held on December 12, 2023, to provide more information regarding this Programmatic EIS. That meeting addressed the Tribe's needs and they decided not to pursue being a cooperating agency at that time. No further correspondence has been received from the Kiowa Tribe to date.

Bureau of Safety and Environmental Enforcement

The BSEE, as a sister Department of the Interior agency, has responsibilities under the current BOEM-BSEE Memorandum of Agreement (MOA) for NEPA and Environmental Compliance, as outlined in Section III of the MOA. The MOA establishes a general framework for coordination between BOEM and BSEE on environmental issues. The MOA outlines BOEM and BSEE's National Environmental Policy Act responsibilities to ensure adequate environmental review of energy and marine mineral resource activities on the OCS. Through this MOA, the two bureaus minimize duplication of efforts, promote consistency in procedures and regulations, and resolve disputes. The BSEE has been working as a Cooperating Agency through the MOA and formally requested to serve as a Cooperating Agency for this Programmatic EIS, via email, on October 20, 2022. BOEM met with BSEE on November 1, 2023, to discuss the scope of the Programmatic EIS, and April 9, 2024, to kickoff BSEE collaboration on the preparation of the Draft GOM Oil and Gas Programmatic EIS. BSEE assisted with document preparation by providing guidance and expertise on matters relating to compliance, operating trends, and accidental events.

National Park Service

BOEM received a Cooperating Agency request in a letter from the NPS dated November 1, 2023, in response to scoping for this Programmatic EIS. BOEM met with the NPS on February 7, 2024, to discuss the scope of the Programmatic EIS. The NPS reiterated the same concerns from the scoping comment letter and provided data layers to BOEM to show areas of concern. Data layers provided to BOEM included the National Park System Boundary; National Natural Landmarks; Rivers on the Nationwide Rivers Inventory; National Heritage Areas; Properties listed in the National Register of Historic Places, including National Historic Landmarks; and Legislated Wilderness Areas. BOEM mapped these areas overlaid with the proposed alternatives and considered those that were in the project area (features on the OCS and coast). Refer to **Figure A.8-1** for an example of the maps.

Most of the features were inland and not considered as they were not within the project area. There were also no features on the OCS. Coastal features included areas on the National Register of Historic Places, National Historic Landmarks, National Heritage Areas, and the National Park System Boundary around the Gulf Islands National Seashore.

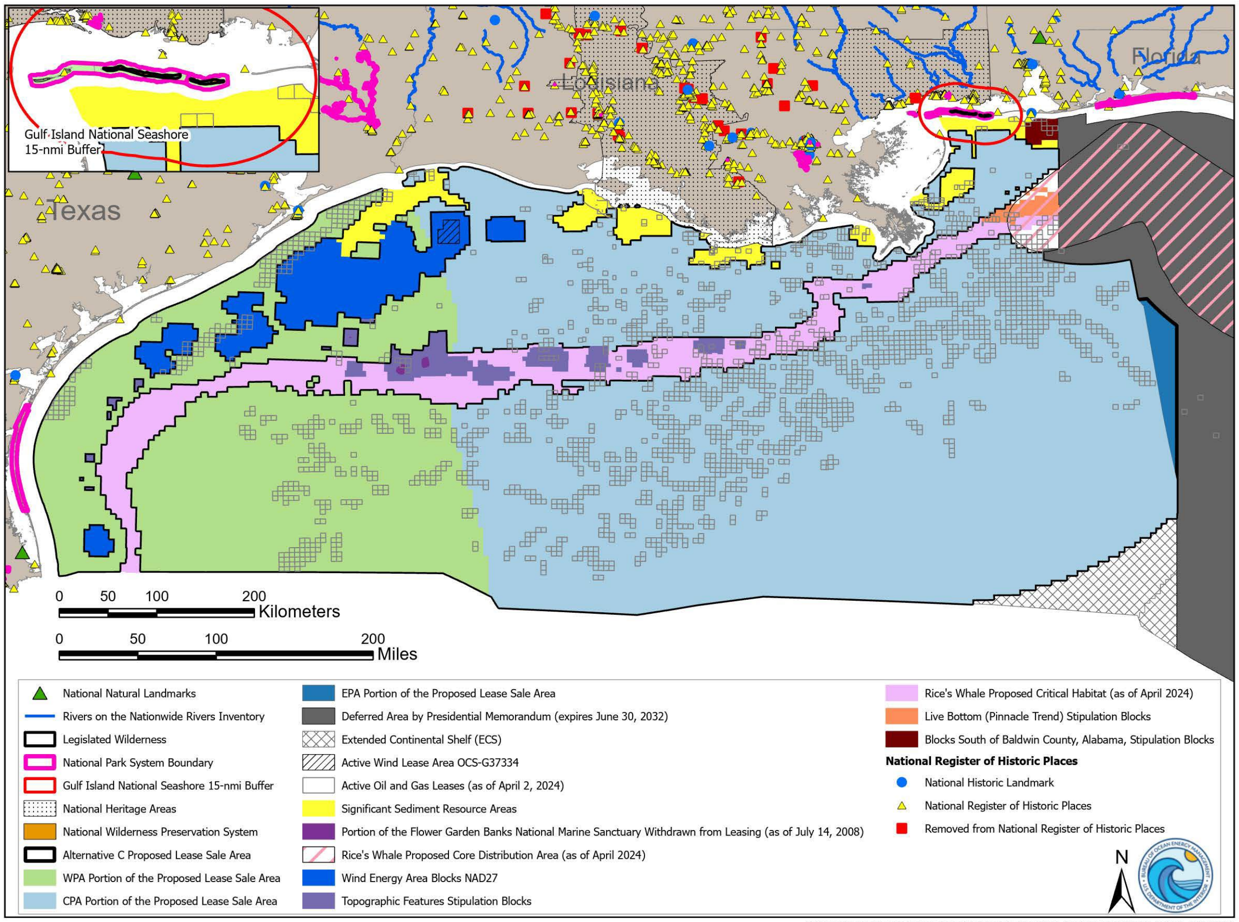

Figure A.8-1. Data Layers Provided by the National Park Service Overlaid with Alternative C.

As part of the NEPA process, BOEM conducts Section 106 of the National Historic Preservation Act consultations with State Historic Preservation Offices for site-specific permitted activities with Areas of Potential Effect in State waters (refer to **Section A.6**). No recent consultations have identified historic properties with the potential to be adversely affected by those activities. Any future site-specific activity would also undergo the same review, and therefore, each of these areas of concern to the NPS will be carefully considered through the Section 106 Consultation process.

The NPS also reiterated their concern over leasing in OCS blocks within 15 nmi (17 mi; 27 km) of Gulf Islands National Seashore (GUIS) and requested that those blocks not be leased. In order to identify which OCS blocks would be fall within the NPS area of concern, BOEM mapped and analyzed the whole and partial OCS blocks available for lease under Alternatives B, C, and D within 15 nmi (17 mi; 27 km) of the GUIS. Whole and partial OCS blocks within 15 nmi (17 mi; 27 km) of the GUIS available for lease under Alternative B are listed in **Table A.8-1**. The total acreage of this area is

410,495.8 acres. Whole and partial OCS blocks within 15 nmi (17 mi; 27 km) of the GUIS available for lease under Alternatives C and D are listed in **Table A.8-1**. The total acreage of this area is 153,871.8 acres. As a mitigating measure to address the NPS concerns, BOEM provides the Gulf Islands National Seashore Information to Lessees to make them aware that post-lease plans submitted by lessees proposing development of whole and partial lease blocks located within the first 12 mi (19 km) of Federal waters near the GUIS may be subject to additional review in order to minimize visual impacts from development operations on these blocks.

Table A.8-1. Whole and Partial OCS Blocks Available for Lease within a 15-Nautical Mile Buffer Around the Gulf Islands National Seashore Under Alternatives B, C, and D.

Alternative B	Alternatives C and D
CA1, MO765, MO766, MO767, MO778, MO779, MO809, MO810, MO811, MO812, MO813, MO814, MO815, MO816, MO817, MO818, MO819, MO820, MO821, MO822, MO823, MO824, MO853, MO854, MO855, MO856, MO857, MO858, MO859, MO860, MO861, MO862, MO863, MO864, MO865, MO866, MO867, MO868, MO897, MO898, MO899, MO900, MO901, MO902, MO903, MO904, MO905, MO906, MO907, MO908, MO909, MO910, MO911, MO942, MO943, MO944, MO945, MO946, MO947, MO948, MO949, MO950, MO951, MO952, MO953, MO954, MO955, MO987, MO988, MO989, MO990, MO991, MO992, MO993, MO994, MO995, MO996, MO997, MO998, VK21, VK22, VK23, VK24, VK25, VK26, VK27, VK28	MO943, MO944, MO945, MO948, MO949, MO950, MO951, MO952, MO953, MO987, MO988, MO989, MO990, MO992, MO993, MO994, MO995, MO996, MO997, MO998, VK21, VK22, VK24, VK25, VK26, VK27, VK28

CA = Chandeleur Area; MO = Mobile Area; VK = Viosca Knoll Area.

BOEM considered the information provided by the NPS as part of this Programmatic EIS and met with the NPS to discuss the analysis BOEM conducted using the data provided.

National Marine Fisheries Service

BOEM received a Cooperating Agency request in a letter from the National Marine Fisheries Service Southeast Regional Office (NMFS SERO) dated November 3, 2023, in response to scoping for this Programmatic EIS. BOEM met with the NMFS SERO on February 15, 2024, to discuss the scope of the Programmatic EIS and their role as a cooperating agency. The NMSF SERO did not provide any additional concerns from the scoping comment letter during the meeting. BOEM requested that the NMFS SERO provide any data or information they wish considered in the Programmatic EIS by March 1, 2024. The NMSF SERO did not provide any information to BOEM. BOEM considered the comments the NMFS SERO provided during scoping in preparation of this Programmatic EIS and met with the NMFS SERO to discuss our analysis in this Programmatic EIS. Issues related to specific Trust Resources are analyzed in **Chapters 4.3, 4.4, 4.5, 4.6, 4.8, 4.9, 4.10, and 4.11**. Through conversation with NMFS, the use of marine spatial planning tools was identified as a potential direction for future OCS oil and gas lease sale planning exercises and not for this effort.

Other areas of NMFS' expertise, such as the Endangered Species Act and Magnuson-Stevens Fisheries Conservation and Management Act, are managed through formal consultation as described above. BOEM does not have an active role in the administration of the Marine Mammal Protection Act (MMPA). Authorizations for activities under the MMPA are applied for directly by operators to NOAA; however, BOEM analyzes the potential impacts to marine mammals in **Chapter 4.8**. The Fish and Wildlife Coordination Act has been determined to not be applicable to this action.

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APPENDIX B

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B REFERENCES

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APPENDIX C

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Deborah Miller, Technical Editor
Aditi Mirani, Economist
William Moore, Geographer, Mapping and Automation Section
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Trevis Olivier, Environmental Specialist
Christopher Page, Supervisor, Social Sciences Unit
Charles Paris, Economist
Stephen Pomes, Librarian
Cholena Ren, Physical Scientist
Dustin Reuther, Social Scientist
Mary Kate Rogener-DeWitt, Marine Biologist
Catherine Rosa, Environmental Protection Specialist
John Schiff, Physical Scientist
Katherine Segarra, Supervisor, Biological Sciences Unit
Scott Sorset, Marine Archaeologist
Mariana Steen, Marine Biologist
Taylor Stoni, Marine Biologist
Christopher Talbot, Geographer, Mapping and Automation Section
Sara Thompson, Information Management Specialist
Susan Erin O'Reilly Vaughan, Supervisor, Physical/Chemical Sciences Unit
Eric Wolvovsky, Meteorologist

Appendix D

Glossary

D GLOSSARY

Acute—Sudden, short term, severe, critical, crucial, intense, but usually of short duration, as opposed to chronic. Effects associated with acute can vary depending on the context of its use (e.g., acute [short-term] exposure could be more or less problematic than chronic [long-term] exposure).

Anaerobic—Capable of growing in the absence of molecular oxygen.

Annular preventer—A component of the pressure control system in the BOP that forms a seal in the annular space around any object in the wellbore or upon itself, enabling well control operations to commence.

Anthropogenic—Coming from human sources, relating to the effect of humankind on nature.

Antipatharian Transitional Zone—The area located between 50 and 90 m (164 and 295 ft), where available light is reduced and there is a gradual ecosystem change from tropical shallow-water corals that are dependent on light to deeper water species, such as antipatharian black corals that are not.

API gravity—A standard adopted by the American Petroleum Institute for expressing the specific weight of oil.

Aromatic—Class of organic compounds containing benzene rings or benzenoid structures.

Attainment area—An area that is shown by monitored data or by air-quality modeling calculations to be in compliance with primary and secondary ambient air quality standards established by USEPA.

Barrel (bbl)—A volumetric unit used in the petroleum industry; equivalent to 42 U.S. gallons or 158.99 liters.

Benthic—On or in the bottom of the sea.

Biological Opinion—The FWS or NMFS evaluation of the impact of a proposed action on endangered and threatened species, in response to formal consultation under Section 7 of the Endangered Species Act.

Block—A geographical area portrayed on official BOEM protraction diagrams or leasing maps that contains approximately 5,760 ac (2,331 ha; 9 mi^2).

Blowout—An uncontrolled flow of fluids below the mudline from appurtenances on a wellhead or from a wellbore.

Blowout preventer (BOP)—One of several valves installed at the wellhead to prevent the escape of pressure either in the annular space between the casing and drill pipe or in open hole (i.e., hole with no drill pipe) during drilling completion operations. Blowout preventers on jackup or platform rigs are located at the water's surface; on floating offshore rigs, BOPs are located on the seafloor.

Cetacean—Aquatic mammal of the order Cetacea, such as whales, dolphins, and porpoises.

Chemosynthetic—Organisms that obtain their energy from the oxidation of various inorganic compounds rather than from light (photosynthetic).

Coastal waters—Waters within the geographical areas defined by each State's Coastal Zone Management Program.

Coastal wetlands—forested and nonforested habitats, mangroves, and marsh islands exposed to tidal activity. These areas directly contribute to the high biological productivity of coastal waters by input of detritus and nutrients, by providing nursery and feeding areas for shellfish and finfish, and by serving as habitat for birds and other animals.

Coastal zone—The coastal waters (including the lands therein and thereunder) and the adjacent shorelands (including the waters therein and thereunder) strongly influenced by each other and in proximity to the shorelines of several coastal states; the zone includes islands, transitional and intertidal areas, salt marshes, wetlands, and beaches, and it extends seaward to the outer limit of the United States territorial sea. The zone extends inland from the shorelines only to the extent necessary to control shorelands, the uses of which have a direct and significant impact on the coastal waters. Excluded from the coastal zone are lands the use of which is by law subject to the discretion of or which is held in trust by the Federal Government, its officers, or agents (also refer to State coastal zone boundaries).

Completion—Conversion of a development well or an exploration well into a production well.

Condensate—Liquid hydrocarbons produced with natural gas; they are separated from the gas by cooling and various other means. Condensates generally have an API gravity of 50°-120°.

Continental margin—The ocean floor that lies between the shoreline and the abyssal ocean floor, includes the continental shelf, continental slope, and continental rise.

Continental shelf—General term used by geologists to refer to the continental margin province that lies between the shoreline and the abrupt change in slope called the shelf edge, which generally occurs in the Gulf of Mexico at about the 200-m (656-ft) water depth. The continental shelf is characterized by a gentle slope (about 0.1°). This is different from the juridical term used in Article 76 of the United Nations Convention on the Law of the Sea Royalty Payment (refer to the definition of Outer Continental Shelf).

Continental slope—The continental margin province that lies between the continental shelf and continental rise, characterized by a steep slope (about 3°-6°).

Critical habitat—Specific areas essential to the conservation of a protected species and that may require special management considerations or protection.

Crude oil—Petroleum in its natural state as it emerges from a well or after it passes through a gas-oil separator, but before refining or distillation. An oily, flammable, bituminous liquid that is essentially a complex mixture of hydrocarbons of different types with small amounts of other substances.

Delineation well—A well that is drilled for the purpose of determining the size and/or volume of an oil or gas reservoir.

Demersal—Living at or near the bottom of the sea.

Development—Activities that take place following discovery of economically recoverable mineral resources, including geophysical surveying, drilling, platform construction, operation of onshore support facilities, and other activities that are for the purpose of ultimately producing the resources.

Development and Production Plan (DPP)—A document that must be prepared by the operator and submitted to BOEM for approval before any development and production activities are conducted on a lease or unit in any OCS area other than the western Gulf of Mexico.

Development Operations Coordination Document (DOCD)—A document that must be prepared by the operator and submitted to BOEM for approval before any development or production activities are conducted on a lease in the western Gulf of Mexico.

Development well—A well drilled to a known producing formation to extract oil or gas; a production well; distinguished from a wildcat or exploration well and from an offset well.

Direct employment—Consists of those workers involved in the primary industries of oil and gas exploration, development, and production operations (Standard Industrial Classification Code 13—Oil and Gas Extraction).

Discharge—Something that is emitted; flow rate of a fluid at a given instant expressed as volume per unit of time.

Dispersant—A suite of chemicals and solvents used to break up an oil slick into small droplets, which increases the surface area of the oil and hastens the processes of weathering and microbial degradation.

Dispersion—A suspension of finely divided particles in a medium.

Drilling mud—A mixture of clay, water or refined oil, and chemical additives pumped continuously downhole through the drill pipe and drill bit, and back up the annulus between the pipe and the walls of the borehole to a surface pit or tank. The mud lubricates and cools the drill bit, lubricates the drill pipe as it turns in the wellbore, carries rock cuttings to the surface, serves to keep the hole from crumbling or collapsing, and provides the weight or hydrostatic head to prevent extraneous fluids from entering the well bore and to downhole pressures; also called drilling fluid.

Economically recoverable resources—An assessment of hydrocarbon potential that takes into account the physical and technological constraints on production and the influence of costs of exploration and development and market price on industry investment in OCS exploration and production.

Effluent—The liquid waste of sewage and industrial processing.

Effluent limitations—Any restriction established by a State or USEPA on quantities, rates, and concentrations of chemical, physical, biological, and other constituents discharged from point sources into U.S. waters, including schedules of compliance.

Epifaunal—Animals living on the surface of hard substrate.

Essential habitat—Specific areas crucial to the conservation of a species and that may necessitate special considerations.

Estuary—Coastal semi-enclosed body of water that has a free connection with the open sea and where freshwater meets and mixes with seawater.

Eutrophication—Enrichment of nutrients in the water column by natural or artificial methods accompanied by an increase of respiration, which may create an oxygen deficiency.

Exclusive Economic Zone (EEZ)—The maritime region extending 200 nmi (230 mi; 370 km) from the baseline of the territorial sea, in which the United States has exclusive rights and jurisdiction over living and nonliving natural resources.

Exploration Plan (EP)—A plan that must be prepared by the operator and submitted to BOEM for approval before any exploration or delineation drilling is conducted on a lease.

Exploration well—A well drilled in unproven or semi-proven territory to determining whether economic quantities of oil or natural gas deposit are present.

False crawls—Refers to when a female sea turtle crawls up on the beach to nest (perhaps) but does not and returns to the sea without laying eggs.

Field—An accumulation, pool, or group of pools of hydrocarbons in the subsurface. A hydrocarbon field consists of a reservoir in a shape that will trap hydrocarbons and that is covered by an impermeable, sealing rock.

Floating production, storage, and offloading (FPSO) system—A tank vessel used as a production and storage base; produced oil is stored in the hull and periodically offloaded to a shuttle tanker for transport to shore.

Gathering lines—A pipeline system used to bring oil or gas production from a number of separate wells or production facilities to a central trunk pipeline, storage facility, or processing terminal.

Geochemical—Of or relating to the science dealing with the chemical composition of and the actual or possible chemical changes in the crust of the earth.

Geophysical survey—A method of exploration in which geophysical properties and relationships are measured remotely by one or more geophysical methods.

Habitat—A specific type of environment that is occupied by an organism, a population, or a community.

Hermatypic coral—Reef-building corals that produce hard, calcium carbonate skeletons and that possess symbiotic, unicellular algae within their tissues.

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

Hermatypic—Corals in the order Scleractinia that build reefs by depositing hard calcareous material for their skeletons, forming the stony framework of the reef. Corals that do not contribute to coral reef development are referred to as ahermatypic (non-reef-building) species.

Hydrocarbons—Any of a large class of organic compounds containing primarily carbon and hydrogen. Hydrocarbon compounds are divided into two broad classes: aromatic and aliphatics. They occur primarily in petroleum, natural gas, coal, and bitumens.

Hypoxia—Depressed levels of dissolved oxygen in water, usually resulting in decreased metabolism.

Incidental take—Takings that result from, but are not the purpose of, carrying out an otherwise lawful activity (e.g., fishing) conducted by a Federal agency or applicant (refer to Taking).

Infrastructure—The facilities associated with oil and gas development, e.g., refineries, gas processing plants, etc.

Jack-up rig—A barge-like, floating platform with legs at each corner that can be lowered to the sea bottom to raise the platform above the water.

Kick—A deviation or imbalance, typically sudden or unexpected, between the downward pressure exerted by the drilling fluid and the upward pressure of *in-situ* formation fluids or gases.

Landfall—The site where a marine pipeline comes to shore.

Lease—Authorization that is issued under Section 8 or maintained under Section 6 of the Outer Continental Shelf Lands Act and that authorizes exploration for, and development and production of, minerals.

Lease sale—The competitive auction of leases granting companies or individuals the right to explore for and develop certain minerals under specified conditions and periods of time.

Lease term—The initial period for oil and gas leases, usually a period of 5, 8, or 10 years depending on water depth or potentially adverse conditions.

Lessee—A party authorized by a lease, or an approved assignment thereof, to explore for and develop and produce the leased deposits in accordance with regulations at 30 CFR part 250 and 30 CFR part 550.

Littoral zone—Marine ecological realm that experiences the effects of tidal and longshore currents and breaking waves to a depth of 5-10 m (16-33 ft) below the low-tide level, depending on the intensity of storm waves.

Longshore sediment transport—The cumulative movement of beach sediment along the shore (and nearshore) by waves arriving at an angle to the coastline and by currents generated by such waves.

Macondo—Prospect name given by BP to the Mississippi Canyon Block 252 exploration well that the *Deepwater Horizon* rig was drilling when a blowout occurred on April 20, 2010.

***Macondo* spill**—The name given to the oil spill that resulted from the explosion and sinking of the *Deepwater Horizon* rig from the period between April 24, 2010, when search and recovery vessels on site reported oil at the sea surface, and September 19, 2010, when the uncontrolled flow from the *Macondo* well was capped.

Marshes—Persistent, emergent, nonforested wetlands characterized by predominantly cordgrasses, rushes, and cattails.

Military warning area—An area established by the U.S. Department of Defense within which military activities take place.

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

Naturally occurring radioactive materials (NORM)—naturally occurring material that emits low levels of radioactivity, originating from processes not associated with the recovery of radioactive material. The radionuclides of concern in NORM are Radium-226, Radium-228, and other isotopes in the radioactive decay chains of uranium and thorium.

Nepheloid—A layer of water near the bottom that contains significant amounts of suspended sediment.

Nonattainment area—An area that is shown by monitoring data or by air-quality modeling calculations to exceed primary or secondary ambient air quality standards established by USEPA.

Nonhazardous oil-field wastes (NOW)—Wastes generated by exploration, development, or production of crude oil or natural gas that are exempt from hazardous waste regulation under the Resource Conservation and Recovery Act (*Regulatory Determination for Oil and Gas and Geothermal Exploration, Development and Production Wastes,* dated June 29, 1988, 53 FR 25446; July 6, 1988). These wastes may contain hazardous substances.

Oceanic zone—Offshore water >200 m (656 ft) deep. It is the region of open sea beyond the edge of the continental shelf and includes 65 percent of the ocean's completely open water.

Offloading—Unloading liquid cargo, crude oil, or refined petroleum products.

Operational discharge—Any incidental pumping, pouring, emitting, emptying, or dumping of wastes generated during routine offshore drilling and production activities.

Operator—An individual, partnership, firm, or corporation having control or management of operations on a leased area or portion thereof. The operator may be a lessee, designated agent of the lessee, or holder of operating rights under an approved operating agreement.

Organic matter—Material derived from living plants or animals.

Outer Continental Shelf (OCS)—All submerged lands that comprise the continental margin adjacent to the United States and seaward of State offshore lands.

Passerines—Perching birds (members of the Order Passeriformes) and songbirds.

Potential Biological Removal (PBR)—Of or pertaining to the open sea; associated with open water beyond the direct influence of coastal systems.

Pelagic—Of or pertaining to the open sea; associated with open water beyond the direct influence of coastal systems.

Plankton—Passively floating or weakly motile aquatic plants (phytoplankton) and animals (zooplankton).

Platform—A steel or concrete structure from which offshore development wells are drilled.

Play—A prospective subsurface area for hydrocarbon accumulation that is characterized by a particular structural style or depositional relationship.

Primary production—Organic material produced by photosynthetic or chemosynthetic organisms.

Produced water—Total water discharged from the oil and gas extraction process; production water or production brine.

Production—Activities that take place after the successful completion of any means for the extraction of resources, including bringing the resource to the surface, transferring the produced resource to shore, monitoring operations, and drilling additional wells or workovers.

Province—A spatial entity with common geologic attributes. A province may include a single dominant structural element such as a basin or a fold belt, or a number of contiguous related elements.

Ram—The main component of a blowout preventer designed to shear casing and tools in a wellbore or to seal an empty wellbore. A blind shear ram accomplishes the former and a blind ram the latter.

Recoverable reserves—The portion of the identified hydrocarbon or mineral resource that can be economically extracted under current technological constraints.

Recoverable resource estimate—An assessment of hydrocarbon or mineral resources that takes into account the fact that physical and technological constraints dictate that only a portion of resources can be brought to the surface.

Recreational beaches—Frequently visited, sandy areas along the Gulf of Mexico shorefront that support multiple recreational activities at the land-water interface. Included are National Seashores, State Park and Recreational Areas, county and local parks, urban beachfronts, and private resorts.

Refining—Fractional distillation of petroleum, usually followed by other processing (e.g., cracking).

Relief—The difference in elevation between the high and low points of a surface.

Reserves—Proved oil or gas resources.

Rig—A structure used for drilling an oil or gas well.

Riser insertion tube tool—A "straw" and gasket assembly improvised during the *Macondo* spill response that was designed to siphon oil and gas from the broken riser of the *Deepwater Horizon* rig lying on the sea bottom (an early recovery strategy for the *Macondo* spill in May 2010).

Royalty—A share of the minerals produced from a lease paid in either money or "in-kind" to the landowner by the lessee.

Rugosity—A measure of small-scale variations of amplitude in the height of a surface. As a measure of complexity, rugosity is presumed to be an indicator of the amount of available habitat available for colonization by benthic organisms (those attached to the seafloor), and shelter and foraging area for mobile organisms.

Saltwater intrusion—Saltwater invading a body of freshwater.

Sciaenids—Fishes belonging to the croaker family (Sciaenidae).

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

Sediment—Material that has been transported and deposited by water, wind, glacier, precipitation, or gravity; a mass of deposited material.

Seeps (hydrocarbon)—Gas or oil that reaches the surface along bedding planes, fractures, unconformities, or fault planes.

Sensitive area—An area containing species, populations, communities, or assemblages of living resources, that is susceptible to damage from normal OCS oil- and gas-related activities. Damage includes interference with established ecological relationships.

Shear ram—The component in a BOP that cuts, or shears, through the drill pipe and forms a seal against well pressure. Shear rams are used in floating offshore drilling operations to provide a quick method of moving the rig away from the hole when there is no time to trip the drill stem out of the hole.

Site fidelity or philopatry—The tendency to return to a previously occupied location.

Spill of National Significance—Designation by the USEPA Administrator under 40 CFR § 300.323 for discharges occurring in the inland zone and the Commandant of the U.S. Coast Guard for discharges occurring in the coastal zone, authorizing the appointment of a National Incident Commander for spill-response activity.

State coastal zone boundary—The State coastal zone boundaries for each CZMA-affected State are defined at https://coast.noaa.gov/czm/media/StateCZBoundaries.pdf.

Structure—Any OCS facility that extends from the seafloor to above the waterline; in petroleum geology, any arrangement of rocks that may hold an accumulation of oil or gas.

Subarea—A discrete analysis area.

Subsea isolation device—An emergency disconnection and reconnection assembly for the riser at the seafloor.

Supply vessel—A boat that ferries food, water, fuel, and drilling supplies and equipment to an offshore rig or platform and returns to land with refuse that cannot be disposed of at sea.

Taking—To harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect any endangered or threatened species, or to attempt to engage in any such conduct (including actions that induce stress, adversely impact critical habitat, or result in adverse secondary or cumulative impacts). Harassments are the most common form of taking associated with OCS Program activities.

Tension-leg platform (TLP)—A production structure that consists of a buoyant platform tethered to concrete pilings on the seafloor with flexible cable.

Tidal prism—The volume of water in an estuary or inlet between mean high tide and mean low tide, or the volume of water leaving an estuary at ebb tide.

Traditional cultural properties—Property that is eligible for inclusion in the National Register of Historic Places based on its associations with the cultural practices, traditions, beliefs, lifeways, arts, crafts, or social institutions of a living community.

Trunkline—A large-diameter pipeline receiving oil or gas from many smaller tributary gathering lines that serve a large area; common-carrier line; main line.

Turbidity—Reduced water clarity due to the presence of suspended matter.

Volatile organic compound (VOC)—Any organic compound that is emitted to the atmosphere as a vapor.

Water test areas—Areas within the eastern Gulf where U.S. Department of Defense research, development, and testing of military planes, ships, and weaponry take place.

Weathering (of oil)—The aging of oil due to its exposure to the atmosphere, causing marked alterations in its physical and chemical makeup.

APPENDIX E

CONSULTATION CORRESPONDENCE

E CONSULTATION CORRESPONDENCE

United States Department of the Interior

BUREAU OF OCEAN ENERGY
MANAGEMENT, REGULATION, AND ENFORCEMENT

Gulf of Mexico OCS Region
1201 Elmwood Park Boulevard
New Orleans, Louisiana 70123-2394

In Reply Refer To: MS 5430

JUL 30 2010

Dr. Roy E Crabtree, Ph.D.
Regional Administrator
Southeast Region
National Marine Fisheries Service
263 13th Avenue South
St. Petersburg, Florida 33701

Dear Dr. Crabtree,

The Bureau of Offshore Energy Management, Regulation, and Enforcement (BOEM; formerly the Minerals Management Service) requests that the National Marine Fisheries Service (NMFS) reinitiate consultation (based on the existing consultation and resulting Biological Opinion (BO) dated June 29, 2007) under Section 7 of the Endangered Species Act (ESA) of 1973 on the effects of the Five-Year Outer Continental Shelf Oil and Gas Leasing Program (2007-2012) in the Central and Western Planning Areas of the Gulf of Mexico. This request is in response to the Deepwater Horizon (DWH) incident and is meant to comply with 50 CFR § 402.16.

BOEM believes the DWH incident and the resulting oil spill necessitate this reinitiation action. We understand the oil spill and the associated impacts to listed species and designated critical habitat cannot be fully quantified at this time and that some potentially relevant information will not be available until after NMFS completes its emergency response consultations under the ESA. However, we acknowledge that the spill volumes and scenarios used in the analysis for the existing NMFS BO need to be readdressed given the "rare event" of a spill exceeding 420,000 gallons as referenced in the current NMFS BO has occurred and that affects to and the status of some listed species or designated critical habitats may have been altered as a result of the DWH incident and therefore require further consideration.

We also recognize that both NMFS and BOEM will need to agree upon an extended consultation timeframe in order to allow for NMFS to first complete the emergency response consultations and re-establish the environmental baseline. Further, we recognize that oil spill response efforts have required and may continue to require much of the NMFS's resources. We ask that you provide us an initial estimate on a consultation timeframe. We understand, however, that this timeframe may be adjusted depending on the timing and outcome of the aforementioned actions.

We will consider the existing NMFS BO to remain in effect until the reinitiated consultation is completed and a new BO is available. In the interim, BOEM will continue to comply with all Reasonable and Prudent Measures and their Terms and Conditions under this existing BO along with implementing the current BOEM-imposed mitigation, monitoring and reporting requirements. In addition, BOEM will continue to institute the BO's Conservation Recommendations, such as pile driving noise characterization, standardization of observer qualifications and protocols, reduction of marine debris, and general scientific research efforts on the effects of oil and gas activities on listed species and designated critical habitat. Based on the most recent and best available information at the time, BOEM will also continue to closely evaluate and assess risks to listed species and designated critical habitat in upcoming environmental compliance documentation under the National Environmental Policy Act and other statutes. Further, BOEM will continue to provide NMFS with any additional information relevant to this ESA Section 7 consultation reinitiation if and when it becomes available.

We look forward to working with NMFS during this formal consultation reinitiation process. If you have any questions or require any additional information, please contact Deborah Epperson, Protected Species Biologist, Leasing and Environment Division, Deborah.Epperson@mms.gov or 504-736-3257.

Sincerely,

Joseph A. Christopher
Regional Supervisor

United States Department of the Interior

BUREAU OF OCEAN ENERGY
MANAGEMENT, REGULATION, AND ENFORCEMENT

Gulf of Mexico OCS Region
1201 Elmwood Park Boulevard
New Orleans, Louisiana 70123-2394

In Reply Refer To: MS 5430

JUL 30 2010

Mr. James Boggs, Field Supervisor
Louisiana Field Office
U.S. Fish and Wildlife Service
646 Cajundome Boulevard, Suite 400
Lafayette, Louisiana 70506-4290

Dear Mr. Boggs,

The Bureau of Offshore Energy Management, Regulation, and Enforcement (BOEM; formerly the Minerals Management Service) requests that the Fish and Wildlife Service (FWS) reinitiate consultation (based on the existing consultation dated September 14, 2007) under Section 7 of the Endangered Species Act (ESA) of 1973 on the effects of the Five-Year Outer Continental Shelf Oil and Gas Leasing Program (2007-2012) in the Central and Western Planning Areas of the Gulf of Mexico. This request is in response to the Deepwater Horizon (DWH) incident and is meant to comply with 50 CFR § 402.16.

The existing consultation was completed using the informal consultation process and found that this program was not likely to adversely affect listed species or designated critical habitats. The FWS provided its written concurrence with that determination in a letter to BOEM dated September 14, 2007. At this time, BOEM believes the DWH incident and the resulting oil spill necessitate reconsideration of this ESA consultation. We understand the oil spill and the associated impacts to listed species and designated critical habitat cannot be fully quantified at this time and that some potentially relevant information will not be available until after the FWS completes its emergency response consultations under the ESA. However, we acknowledge that the spill volumes and scenarios used in the analysis for the existing FWS consultation need to be readdressed given the "rare event" of a spill exceeding 420,000 gallons as referenced in the current NMFS BO has occurred and that affects to and the status of some listed species or designated critical habitats may have been altered as a result of the DWH incident and therefore require further consideration.

We also recognize that both FWS and BOEM will need to agree upon an extended consultation timeframe in order to allow for FWS to first complete the emergency response consultations and re-establish the environmental baseline. Further, we recognize that oil spill response efforts have required and may continue to require much of the FWS's resources. We ask that you provide us an initial estimate on a consultation timeframe. We understand, however, that this timeframe may be adjusted depending on the timing and outcome of the aforementioned actions.

We will consider the existing consultation to remain in effect until the reinitiated consultation is completed. In the interim, BOEM will continue to comply with all mitigation, monitoring and reporting measures incorporated into the September 14, 2007 consultation by FWS. Based on the most recent and best available information at the time, BOEM will also continue to closely evaluate and assess risks to listed species and designated critical habitat in upcoming environmental compliance documentation under the National Environmental Policy Act and other statutes. Further, BOEM will continue to provide FWS with any additional information relevant to this ESA Section 7 consultation request if and when it becomes available.

We look forward to working with FWS during this consultation reinitiation process. If you have any questions or require any additional information, please contact Deborah Epperson, Protected Species Biologist, Leasing and Environment Division, Deborah.Epperson@mms.gov or 504-736-3257.

Sincerely,

Joseph A. Christopher
Regional Supervisor

United States Department of the Interior

FISH AND WILDLIFE SERVICE
1875 Century Boulevard
Atlanta, Georgia 30345

In Reply Refer To:
FWS/R4/ES

SEP 27 2010

Joseph A. Christopher
Regional Supervisor
Bureau of Ocean Energy Management, Regulation and Enforcement
Gulf of Mexico OCS Region
1201 Elmwood Park Boulevard
New Orleans, Louisiana 70123-2394

RE: MS-5430, Request to Reinitiate Consultation under Section 7 of the Endangered Species Act of 1973 on the Effects of the Five-Year Outer Continental Shelf Oil and Gas Leasing Program (2007-2012) in the Central and Western Planning Areas of the Gulf of Mexico in Response to the Deepwater Horizon Incident.

Dear Mr. Christopher:

The U.S. Fish and Wildlife Service (Service) received the subject request dated July 30, 2010 on August 4, 2010. We concur with your assessment that at this time the Deepwater Horizon incident and the resulting oil spill necessitate reconsideration of the existing consultation dated September 14, 2007, and concluded informally. The incident and resulting oil spill represent new information regarding potential adverse affects to endangered and threatened species that has not previously been assessed. Furthermore, the status of some listed species or designated critical habitats may have been altered as a result of the Deepwater Horizon incident and therefore require further consideration.

As acknowledged in your letter, the Service is fully engaged in oil spill response efforts, which continues to require much of our resources. We are engaged in emergency section 7 consultations with the Coast Guard, U.S. Army Corps of Engineers as well as other federal agencies to minimize the adverse effects of oil spill response efforts on listed species. Once the emergency response efforts cease we will be able to conclude emergency response consultations. Only after we have fully assessed the effects of response actions, as well as the released oil, can we begin to effectively re-assess the effects of the five-year outer continental shelf oil and gas leasing program (2007-2012) in the central and western planning areas of the Gulf of Mexico, as these steps will be necessary to re-establish the environmental baseline of species and habitat status.

At this time it is difficult to predict a timeframe for completion of the aforementioned actions and emergency consultations. Current response activities and level of resource commitment to the response are expected to continue through early December when response activities may be reduced. It may be timely to hold a meeting to discuss the consultation process and timelines after the first of the year.

Mr. Christopher 2

As you have identified, the potential spill volumes and scenarios used in the analysis for the existing consultation do need to be re-addressed given the "rare event" of a spill exceeding 420,000 gallons. We encourage the Bureau to conduct additional modeling to address this scenario and its potential effects on listed species and their designated critical habitats. Additional discussion as to the specifics of the modeling, as well as other information relevant to the consultation should be discussed at a future meeting. Please contact Deborah Fuller (337) 291-3124 at the Lafayette, Louisiana Field Office to schedule a meeting. I look forward to discussing this further.

Sincerely,

"for" Cynthia K. Dohner
Regional Director

United States Department of the Interior

BUREAU OF OCEAN ENERGY MANAGEMENT
Gulf of Mexico OCS Region
1201 Elmwood Park Boulevard
New Orleans, LA 70123-2394

In Reply Refer To: MS 5430

FEB 0 3 2012

Dr. Roy E. Crabtree
Regional Administrator, Southeast Region
National Marine Fisheries Service
263 13th Avenue South
Saint Petersburg, Florida 33701

Dear Dr. Crabtree,

The purpose of this letter is to finalize the interim Endangered Species Act project-specific consultation procedures between the Bureau of Ocean Energy Management (BOEM) and the National Marine Fisheries Service (NMFS). Specifically we are responding to your December 21, 2011 rejoinder to our November 23, 2011 letter (both attached).

These interim procedures are for the Gulf of Mexico oil and gas activities covered by the NMFS June 29, 2007 biological opinion[1]. The BOEM is in the process of completing a biological assessment for a new Section 7 consultation that will supersede this agreement.

Per your request, BOEM has agreed to a 15 calendar day timeline for review of exploration plans (EP) and geological and geophysical (G&G) survey permits. The BOEM also agrees to a 30 calendar day timeline for review of development and production plans (DPP) and development operations coordination documents (DOCD).

As requested, BOEM has clarified (via telecom with NMFS-SERO staff on January 11, 2012) that relevant oil spill response plan (OSRP) information is included in EPs and DOCDs. The NMFS will not require an additional OSRP review. In the event that NMFS needs more information than what is provided in the EP or DOCD, NMFS may request the relevant Regional OSRP on a case-by-case basis.

The BOEM will provide NMFS with the requested documents for review in the following manner:

Type	NMFS Review (calendar days from receipt of BOEM email notification)	Process
G&G Permits	15	1. BOEM posts public information copy on BOEM website (www.BOEM.gov).
EPs	15	2. BOEM sends notification email to NMFS with relevant web link.
DPPs	30	
DOCDs	30	3. NMFS provides comments to BOEM within allotted time.

The primary NMFS point of contact for review of BOEM activities will be Mr. Kyle Baker. All emails will be sent directly to him (kyle.baker@noaa.gov). The primary points of contact for BOEM will be Ms. Mimi Griffitt for EPs, DPPs, and DOCDs (michelle.griffitt@boem.gov) and Mr. John Johnson for G&G permits (john.johnson@boem.gov).

Please respond in writing if you concur with this process for interim project-specific consultation. Upon receipt of your concurrence, BOEM will begin sending all new permit/plan applications for your review.

For additional information or questions regarding these interim consultation procedures please contact Dr. Deborah Epperson at deborah.epperson@boem.gov or at (504) 736-3257.

John Rodi

Enclosures

cc: J. Bennett (MS 4042)

1 National Marine Fisheries Service. 2007. Endangered Species Act biological opinion on the Five-Year Outer Continental Shelf Oil and Gas Leasing Program (2007-2012) in the Central and Western Planning Areas of the Gulf of Mexico. June 29, 2007.

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Southeast Regional Office
263 13th Avenue South
St. Petersburg, FL 33701-5505
727.824.5312, FAX 824.5309
http://sero.nmfs.noaa.gov

FEB 8 2012

F/SER32:KPB

Mr. John Rodi, Regional Director
Bureau of Ocean Energy Management
Gulf of Mexico OCS Region
1201 Elmwood Park Blvd
New Orleans, LA 70123-2394

Re: MS 5430

Dear Mr. Rodi:

This responds to your letter dated February 3, 2012, regarding interim Endangered Species Act (ESA), project-specific consultation procedures with the Bureau of Ocean Energy Management (BOEM). These procedures have been coordinated between personnel from each of our offices. I concur with the implementation of these interim procedures until a new biological opinion is completed on the BOEM/BSEE lease program for the Gulf of Mexico. I look forward to the continued cooperation between our two agencies on these important issues.

For additional coordination regarding these interim consultation procedures, please contact Kyle Baker at kyle.baker@noaa.gov or Adam Brame (adam.brame@noaa.gov) at (727) 824-5312.

Sincerely,

Roy E. Crabtree, Ph.D.
Regional Administrator

United States Department of the Interior

FISH AND WILDLIFE SERVICE
646 Cajundome Blvd.
Suite 400
Lafayette, Louisiana 70506

April 20, 2018

Mr. Michael A. Celata
Regional Director, BOEM
Gulf of Mexico OCS Region
1201 Elmwood Park Boulevard
New Orleans, Louisiana 70123

Mr. Lars Herbst
Regional Director, Gulf of Mexico OCS Region
Bureau of Safety and Environmental Enforcement
1201 Elmwood Park Boulevard
New Orleans, Louisiana 70123

This document transmits the U.S. Fish and Wildlife Service's (Service) biological opinion (BO) on the effects of Bureau of Ocean Energy Management's (BOEM) and Bureau of Safety and Environmental Enforcement's (BSEE) proposed oil and gas leasing, exploration, development, production, decommissioning, and all related activities in the Gulf of Mexico (GOM) Outer Continental Shelf (OCS) within existing leased areas and those areas proposed for future leasing in the Western Planning Area (WPA), the Central Planning Area (CPA), and the Eastern Planning Area (EPA).

Based on our review of the proposed action, as illustrated in the attached BO, formal consultation is not required for this action. No further Endangered Species Act (ESA) consultation with the Service for the proposed action will be necessary for the duration covered under this BO, unless there are new species that become listed, new critical habitat designated, or there are changes in the scope, location, or impacts of the proposed action. Furthermore, future consultations for this action may not warrant formal consultation and could be handled informally dependent upon the likelihood of take.

We appreciate BOEM's continued coordination and cooperation in the conservation of threatened and endangered species and their critical habitat. If you require further assistance regarding ESA coordination, or have questions regarding the content of this letter, please contact Ms. Karen Soileau (337/291-3132) of this office.

Sincerely,

Joseph A. Ranson
Field Supervisor

Louisiana Ecological Services Office

cc: Protected Species Coordinator, BSEE, New Orleans, LA
Energy Coordinator, Ecological Services, FWS, Atlanta, GA (ES/CPA)
ESA Consultation Coordinator, FWS, Southeast Region, Tallahassee, FL
Field Supervisor, Ecological Services, FWS, Daphne, AL
Field Supervisor, Ecological Services, FWS, Jacksonville, FL
Field Supervisor, Ecological Services, FWS, Panama City, FL
Field Supervisor, Ecological Services, FWS, Vero Beach, FL
Field Supervisor, Ecological Services, FWS, Jackson, MS
Field Supervisor, Ecological Services, FWS, Houston, TX
Field Supervisor, Ecological Services, FWS, Corpus Christi, TX
Andrew Strelcheck, Deputy Regional Administrator, NOAA, St. Petersburg, FL
Rachel Sweeney, Protected Resources Division, NOAA, St. Petersburg, FL
LDWF, Baton Rouge, LA

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Silver Spring, MD 20910

MAR 13 2020

Refer to NMFS No.: FPR-2017-9234

Dr. Walter Cruikshank
Acting Director, Bureau of Ocean Energy Management
1849 C Street, NW
Washington, D.C. 20240

RE: Endangered Species Act Section 7 programmatic biological opinion on the federally regulated oil and gas program in the Gulf of Mexico

Dear Dr. Cruickshank:

Enclosed is the National Marine Fisheries Service's (NMFS) programmatic biological opinion on the effects of the Bureau of Ocean Energy Management (BOEM) and Bureau of Safety and Environmental Enforcement (BSEE) Gulf of Mexico Oil and Gas Program; and the US Environmental Protection Agency's (USEPA) proposed action of overseeing air emissions and water discharges from the oil and gas program on endangered and threatened species and designated critical habitats under NMFS' jurisdiction. This consultation also considered the NMFS Permits and Conservation Division's issuance of a 5-year regulation pursuant to the Marine Mammal Protection Act, and subsequent letters of authorization for the take of marine mammals incidental to the oil and gas program. We have prepared the programmatic biological opinion pursuant to section 7(a)(2) of the Endangered Species Act, as amended (ESA; 16 U.S.C. 1536(a)(2)).

The programmatic biological opinion addresses activities and actions associated with all past BOEM leases operating in the Gulf of Mexico at present, as well as future actions and activities associated with new leases awarded in the Gulf of Mexico in the first ten years following issuance of this programmatic biological opinion (through approximately 2029). Because each lease is projected to have a 40-year lifespan, the programmatic biological opinion considers all federally regulated oil and gas program activities including: exploration, development (construction), production, and decommissioning (structure removal) in the Gulf of Mexico expected to occur over the next 50 years. This programmatic biological opinion is comprehensive and includes multiple actions and activities associated with the oil and gas program, and has built in annual review processes for adaptive management in order to streamline and reduce the need for individual future ESA consultations.

The following were considered in the biological opinion: sperm whale, Gulf of Mexico Bryde's whale, Northwest Atlantic loggerhead sea turtle, Kemp's ridley sea turtle, North Atlantic Distinct Population Segment and South Atlantic Distinct Population Segment green sea turtle, leatherback sea turtle, hawksbill sea turtle, Gulf sturgeon, giant manta ray, and oceanic whitetip shark; and Gulf sturgeon and loggerhead critical habitat. Based on our assessment, we concluded that:

- The NMFS' Protected Resources Permits and Conservation Division's proposed action (i.e., the MMPA rule) will not be completed at the time the biological opinion is released. The opinion may need to be amended once the MMPA rule is finalized depending on the contents of the final rule.
- The USEPA's proposed action is not likely to adversely affect ESA-listed species or designated critical habitat.
- The BOEM/BSEE's proposed action is not likely to jeopardize the continued existence of sperm whale, Northwest Atlantic loggerhead sea turtle, Kemp's ridley sea turtle, North Atlantic Distinct Population Segment and South Atlantic Distinct Population Segment green sea turtle, leatherback sea turtle, hawksbill sea turtle, Gulf sturgeon, giant manta ray, and oceanic whitetip shark or destroy or adversely modify designated critical habitat; and
- The BOEM/BSEE's proposed action is likely to jeopardize the continued existence of the Gulf of Mexico Bryde's whale. For this reason, the programmatic biological opinion proposes a Reasonable and Prudent Alternative for BOEM and BSEE actions containing mitigation measures to avoid such jeopardy.

This concludes section 7 consultation on this action. The BOEM, BSEE, USEPA, and NMFS Permits and Conservation Division are required to reinitiate formal consultation on this action, where it retains discretionary involvement or control over the action and if: (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this consultation; (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this consultation; or (4) a new species is listed or critical habitat designated that may be affected by the action.

If you have any questions regarding this biological opinion, please contact me at (301) 427-8407 or donna.wieting@noaa.gov, or Cathy Tortorici at (301) 427-8495 or cathy.tortorici@noaa.gov.

Sincerely,

Donna S Wieting

Donna S. Wieting
Director, Office of Protected Resources
National Marine Fisheries Service

cc: Scott Angelle, BSEE
Brent Larson, USEPA Region 6
Molly Davis, USEPA Region 4
Kelly Fortin, USEPA Region 4
Jolie Harrison, NMFS

United States Department of the Interior

BUREAU OF OCEAN ENERGY MANAGEMENT

Gulf of Mexico OCS Region
1201 Elmwood Park Boulevard
New Orleans, LA 70123-2394

In Reply Refer To: GM 673E

Ms. Cathy Tortorici
Division Chief
Endangered Species Act Interagency Cooperation Division Office of Protected Resources
National Marine Fisheries Service
1315 East-West Highway
Silver Spring, Maryland 20910

Via US. Mail and Electronic Mail

Dear Ms. Tortorici:

The Bureau of Ocean Energy Management (BOEM) and the Bureau of Safety and Environmental Enforcement (BSEE, collectively the Bureaus), in the spirit of adaptive management and in agreement with the National Marine Fisheries Service (NMFS), are submitting the following revised procedures for the programmatic biological opinion (BiOp) signed on March 13, 2020, *Biological Opinion for Federally Regulated Oil and Gas Program Activities in the Gulf of Mexico.* We are proposing certain revised procedures and conditions so that some activities previously identified in the activities under the proposed action identified in the BiOp as requiring stepdown review will no longer require said reviews. We propose that rather than requesting step-down reviews by NMFS on these activities, we will instead apply new or revised standardized mitigation measures. In support of this proposal, we are providing information below regarding the activity (e.g., approval of Deepwater Operations Plans [DWOPs]) that clarifies the nature of our existing analyses or mitigation and its effectiveness.

As further explained below, we do not believe that these changes to the conditions and mitigations will significantly change the effects of the action on species or designated critical habitat listed under the Endangered Species Act (ESA), and in most cases will reduce any potential impacts to species or designated habitat. Therefore, BOEM, BSEE and NMFS have agreed that these revised procedures will not trigger reinitiation of consultation under 50 CFR 402.16. We request that NMFS, through a reciprocal letter published to NMFS' website or amendment to the BiOp, make any necessary modifications to the Incidental Take Statement (ITS) and Reasonable and Prudent Measures (RPMs) / Terms & Conditions (T&Cs) from the BiOp to reflect these changes to our action's step-down requirements and mitigation measures.

Background

Due to the programmatic nature of the consultation and broad scope and duration of the actions and activities associated with the proposed action, it was necessary to continue to obtain information about some of the activities that could potentially have adverse impacts to species listed under the ESA after completion of the BiOp. Those activities were subsequently incorporated into a step-down review process as described in the BiOp. The step-down provisions of Section 3.4 of the BiOp identified specific categories of actions or activities anticipated to warrant further review and evaluation by NMFS and BOEM/BSEE (collectively "the agencies"). Those reviews include the following:

- How BOEM/BSEE would evaluate whether such actions would be expected to have effects of an extent and nature consistent with those effects already evaluated in the BiOp;
- Whether there are any potential effects to ESA-listed species that would be different than those already evaluated in the BiOp;
- Whether those effects would be consistent with the effects already evaluated in the BiOp if the activities were modified (e.g., through different mitigation measures); and
- Whether further consultation would be required.

Between April and September 2020, BOEM and BSEE reviewed incoming new and supplemental plans and permit applications for consistency with the BiOp and its RPMs/T&Cs. The Bureaus included NMFS in the step-down review process as necessary prior to BOEM/BSEE approval. Details evolved with each Bureau-level review and with NMFS comments received in response to requests for step-down review. The categories of activities for step-down review[1] that are relevant to the Bureaus' revised procedures outlined in this letter include the use of vessels with moon pools and activities involving slack lines in the water associated with diving and other operations as part of the oil and gas program in the Gulf of Mexico. As a result, BOEM and BSEE, in concert with NMFS, developed standard mitigation measures to be applied as standard conditions of approval (COAs) on these activities. We determined that these standard measures, when applied to these activities, provide greater certainty with respect to the potential effects of these activities on ESA-listed species.

As outlined in 3.4 Step-down Review, "Aspects of this step-down review process may be discussed and possibly revised during annual activity reviews, as necessary (e.g., phasing out of certain type reviews)." Although we have not yet reached an annual review, we are proposing at this time to modify how we manage certain activities such that they will no longer require step-down review. We propose that, instead of doing step-down reviews on these particular activities, we instead will apply a set of standardized mitigation measures where appropriate. As further explained below, we do not believe that this modification will change the effects of the action on ESA-listed species or designated critical habitat, so we do not believe these changes trigger reinitiation of consultation under 50 CFR 402.16. However, we request that NMFS amend its ITS, RPMs, and T&Cs to reflect these changes to the step-down requirements and mitigation measures in the BiOp.

[1] For example, NMFS included in the BiOp a requirement for step-down reviews for seismic surveys. However, BOEM is not proposing at this time any additional mitigations to remove the need for NMFS review of those activities and thus that step-down review will continue.

Below are the categories of activities that we propose would not require further step-down reviews under the revised action. The bulleted list and subsequent descriptions below are BOEM and BSEE's requested changes to the step-down review procedures/protocols currently outlined in the BiOp in the following order:

- Activities that may use slack lines, including diving activities, in the water column;
- Activities that may use a vessel with an enclosed moon pool;
- DWOP; and
- Certain geological and geophysical activities, using equipment operating at and above 180 kHz or using coring.

Use of equipment that entail lines in the water column

There are several types of activities associated with federally regulated oil and gas activities in the Gulf of Mexico that utilize lines in the water column which could result in an entanglement risk to ESA-listed species. These activities include, but are not limited to, the use of diver lines employed during pipeline installation, removal and decommissioning in place activities, and deployment of remotely operated vehicles (ROV) with tethers on drilling rigs.

Divers are employed during pipeline installation and removal, and decommissioning activities for several different functions. They generally conduct the following activities:

- Uncover pipelines, connect and disconnect pipeline segments, connect and disconnect associated equipment, perform cutting activities, install endcaps, bury pipelines and equipment and take instrument readings.
- Setting saws on main structure members for non-explosive removals and on cross members for explosive or non-explosive structures removals.
- Surveying for post-structure removal debris or as a preliminary site clearance even when site clearance trawling activities will be conducted later, and, in some instances, in lieu of trawling.

Other instances where slack-lines may be in the water include operational and/or safety lines, ropes or netting in moon pools.

Through BOEM and BSEE review of permit applications and plans to ensure consistency with the BiOp, BOEM and BSEE have gained a greater understanding of the volume and variety of activities that use lines in the water column associated with both structure removal and pipeline activities. As a result of the increased level of understanding of activities that utilize lines in the water column and the potential risks to ESA-listed species associated with these activities, the agencies jointly developed a programmatic approach, via standard mitigation measures, to minimize potential risks from these activities to ESA-listed species. We will be applying the new mitigation measures, required through the slack-line COAs (see attachment below), to new or modified permits and plans going forward.

The slack-line COAs will be applied to all categories of activities (plans, G&G permitting, pipeline, and structures removals) where slack lines could be utilized. BOEM and BSEE determined that the use of slack lines in the water column is not likely to adversely affect ESA-listed species due to the limited past interactions and low potential for entanglement or entrapment of listed species in these lines. With the application of the standard mitigation measures through the requirement of the slack-line COAs (see attachment below), the potential for entanglement associated with lines in the water column would be further minimized.

BOEM and BSEE would continue to conduct permit application and plan reviews for these activities to ensure compliance with the requirements of the BiOp. In cases where the reviews identify other BiOp-required categories for step-down review, BOEM would still refer the activity to NMFS through the step-down review process. With the application of the slack-line COAs, the potential risk of entanglement associated with slack lines in the water column will be effectively minimized, and therefore we request that no further step-down reviews be required for those permits/projects that have potential lines in the water where the slack line COAs are applied. As this revised process for slack-lines does not significantly change the effects on listed species or designated critical habitat and is expected to only further reduce those effects previously identified, the Bureaus and NMFS agree that this revision does not require reinitiated consultation.

Vessels with Moon pools

Through the plan and permit application reviews, BOEM has determined that moon pools are a feature of a variety of vessels utilized across the federally regulated oil and gas program. Vessels used for diving or drilling activities often contain moon pools. As discussed previously, diving activities are a feature of a variety of tasks associated with structure removals and pipeline installation, removal and decommissioning in place. Additionally, vessels used to support pipeline installation and removal activities may contain moon pools.

Through the plan and permit application review process, BOEM and BSEE have gained a greater understanding of the volume and variety of activities that utilize moon pools. As a result of the increased level of understanding of activities that utilize moon pools, and the potential low risks to ESA-listed species associated with these activities, the agencies jointly developed a programmatic approach, via standard mitigation measures, to minimize potential risks from these activities to ESA-listed species. We will begin applying new mitigation measures, required through the COAs (see attachment below) to new and modified plans and permits going forward.

The moon pool COAs would be applied to all categories of activities (plans, G&G permitting, pipeline and structures removals) where moon pools would be utilized. The range of activities reasonably expected with moon pools are:

- Deploying or retrieving Remotely Operated Vehicles (ROVs);
- Deploying or retrieving Autonomous Underwater Vehicles (AUVs);
- Drilling apparatus deployment, use and retrieval;
- Using various submarine tools that are attached via tethers;
- Use by human divers for entry and exit; and
- Pipelaying or decommissioning activities.

BOEM and BSEE have determined that the use of moon pools in the situations listed above is not likely to adversely affect ESA-listed species due to known limited interactions and the low potential for entanglement or entrapment of listed species within moon pools. The application of the moon pool COAs would further reduce the potential for entanglement or entrapment; therefore, the Bureaus and NMFS concur that consultation does not need to be reinitiated due to these additional COAs and mitigations. If moon pool activities fall outside the scope of those described in the bullets above, then a detailed description of those activities will need to be provided to the Bureau and NMFS and a step-down review would still be required, so that a determination of potential effects to ESA listed species can be made.

BOEM and BSEE would continue to conduct permit application and plan reviews for these activities to ensure compliance with the BiOp during all individual activities. In cases where the reviews identify other BiOp-required categories for step-down reviews, the Bureau will refer the activity to NMFS through the step-down review process. With application of the moon pool COAs, the potential risk of entanglement and entrapment associated with moon pools will be effectively minimized, therefore we request that NMFS concur that no further step-down reviews are required for the specific permit and plan activities that potentially utilize moon pools when the moon pool COAs (see attachment below) are applied.

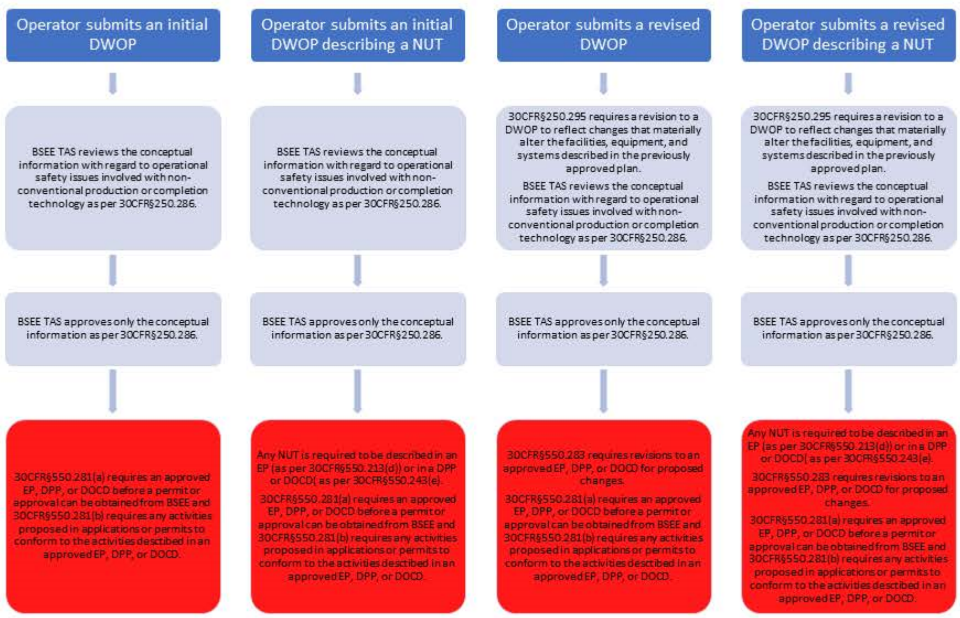
DWOPs

As described in 30 CFR § 250.286, a DWOP is a plan that provides conceptual information for the BSEE Technical Assessment Section to review a deepwater development project, or any other project that uses non-conventional production or completion technology, from a total system approach. The information described in a DWOP may be used as a supplement to other required submittals, but a DWOP "does not replace . . . other submittals required by the regulations such as Exploration Plans (EPs), Development and Production Plans (DPPs), and Development Operations Coordination Documents (DOCDs)" as per 30 CFR § 250.286(a). Additionally, 30 CFR § 550.281(b) also requires that activities permitted by BSEE be addressed in an approved EP, DPP, or DOCD and not just a DWOP. In other words, any actions or activities that may be described or proposed in a DWOP cannot be immediately approved or permitted through that plan because they must first be detailed in an associated EP, DPP, DOCD, and/or an associated permit application submitted for review and approval. BSEE approval of a DWOP does not immediately approve any "on the water" activities that could result in impacts to an endangered species or affect designated critical habitat.

BSEE proposes to no longer submit DWOPs for step-down review, as originally described in Section 3.4 of the BiOp. The associated regulatory requirements for DWOPs only allow for review and approval of the conceptual information, and therefore, do not result in immediate approval of any proposed actions or activities under a DWOP. Any activity that requires step-down review would therefore go through that review at the later plan or permit application stage when the specific, activity details are more certain; therefore, requiring step-down review at the earlier DWOP phase as well is both premature (as no activities can commence before, and the plans will be more certain at, the EP, DPP, DOCD, or permit application stage) and unnecessarily duplicative. The conceptual information provided in a DWOP does not meet the criteria described in section 3.4 of the BiOp because no action nor activity can commence, as per

30 CFR § 250.286. At this point in the regulatory review process NMFS would see only the conceptual information in a DWOP. The proposed actions or activities could only be meaningfully evaluated under the BiOp at the EP, DPP, DOCD, or permit application stage if step-down reviews are required for the relevant activity. New or Unusual Technology (NUT) is defined as technologies that have not been used previously or extensively in a BOEM Outer Continental Shelf (OCS) region or have not been used previously under anticipated operating conditions (30 C.F.R. §550.200).

BSEE created the following chart to describe this regulatory review process:



BSEE conducts reviews of conceptual information under a DWOP for administrative purposes and that review would have no effect on ESA-listed species or critical habitat. Any new and unusual technology proposed under the DWOP review process is required to be represented in an associated, subsequent EP, DPP, DOCD, or permit application to capture that new and unusual technology or other activity requiring step-down review. Therefore, we request that no further step-down reviews be required for DWOPs as the information in these plans will be detailed in an associated EP, DPP, DOCD, or permit application and undergo review by BOEM or BSEE to determine if a step-down review is required at that time. As noted above, as approval of a DWOP results in no effects to listed species or designated critical habitat, this procedural change does not require reinitiation of consultation.

Non-airgun high-resolution geophysical (HRG) survey equipment that operates at and above 180 kHz

As described in the BiOp, non-airgun HRG sources include but are not limited to side-scan sonars, boomers, sparkers (in limited situations) and compressed high-intensity radiated pulse sub-bottom profilers and single-beam or multibeam depth sounders. As described in Appendix A of the BiOp, non-airgun HRG sources with frequencies ≥180 kHz have acoustic characteristics that do not require detailed effects analyses because their frequency ranges are outside the general hearing ranges of all marine mammals, sea turtles and fish. As the HRG sources with frequencies ≥180 kHz would not be detectable by any ESA-listed species, these sources would have "*no effect*" on any ESA-listed species and any associated critical habitat in the Gulf of Mexico.

Therefore, BOEM is requesting that HRG survey activities utilizing equipment that operates exclusively at frequencies ≥180 kHz no longer require further step-down reviews; as HRG surveys at these frequencies result in no effects to listed species or designated critical habitat, this procedural change does not require reinitiation of consultation. BOEM and BSEE would continue to conduct permit and plan reviews for these and similar activities to ensure compliance with the 2020 BiOp and all relevant T&Cs and RPMs (through application of COAs) is ensured during individual activities. In cases where BOEM reviews identify other triggers for step-down review, including the use of HRG survey equipment with operating frequencies <180 kHz, BOEM will still refer those activities to NMFS for step-down reviews. BOEM will continue to document any instances of the use of HRG sources, including those with frequencies ≥180 kHz, in the annual review with NMFS.

Coring activities as part of geotechnical surveys

Coring activities occur as part of geotechnical surveys and are not associated with geophysical surveys (e.g., seismic and HRG surveys). As part of the proposed action in the BiOp, coring activities occur in minimal numbers relative to other G&G activities. Bottom sampling uses devices that penetrate anywhere from a few centimeters to several meters below the sea floor. Samples of near-surface sediments are typically obtained by dropping a piston core or gravity core (a dart or essentially a weighted tube) to the ocean floor and recovering it with an attached wire line. Samples can also be obtained using a grab (a device with a jaw-like mechanism) or with a dredge, which is a wire cage dragged along the sea floor. These coring activities are fully described in the BiOp and are expected to have few to no environmental effects, mainly related to a local and temporary decrease in water quality in the immediate area of the core, effects so minimal that they are either insignificant or discountable. Coring activities currently require step-down review because the BiOp requires that all G&G activities undergo step-down review. However, we propose to no longer carry out step-down reviews for coring activities as originally required under the general category for G&G activities in Section 3.4 of the BiOp, because they were determined not likely to adversely affect ESA-listed species or designated critical habitat. Therefore, this procedural change does not alter the effects on listed species or designated habitat and reinitiation is not required.

Conclusion

As described above, we have determined certain oil and gas activities either have no or little effect on ESA-listed species or, with the additional proposed mitigations, effects can be effectively reduced such that further step-down reviews are unnecessary. While the effects were already so low as to be discountable or would only be reduced with application of the mitigation, the type of effects of the action are not different than those analyzed in the BiOp and the level of effects would not be significantly altered. As such no reinitiation is necessary. Therefore, in the spirit of adaptive management, BOEM and BSEE request that NMFS modify the ITS, RPMs, and T&Cs as necessary to reflect the above changes to the step-down review process.

Again, we appreciate the opportunity to continue to work together on a reasonable implementation of the BiOp.

Sincerely,

AGATHA-
MARIE KALLER

Digitally signed by AGATHA-MARIE KALLER
DN: c=US, o=U.S. Government, ou=Department of the Interior, ou=Bureau of Ocean Energy Management, cn=AGATHA-MARIE KALLER, 0.9.2342.19200300.100.1.1=14001001248643
Date: 2020.11.03 13:47:58 -06'00'

Arie Kaller
Supervisor, Office of Environment, BOEM

I agree:

TOMMY
BROUSSARD

Digitally signed by TOMMY BROUSSARD
Date: 2020.11.03 13:56:28 -06'00'

TJ Broussard
Regional Environmental Officer, Office of Environmental Compliance, BSEE

cc: Michael Celata,
Field Special Assistant – Interior Region 6,
Director, Gulf of Mexico Office; Bureau of Ocean Energy Management
1201 Elmwood Park Blvd (GM333C)
New Orleans, LA 70123

Lars Herbst
Field Special Assistant – Interior Region 4,
Director, Gulf of Mexico OCS Office; Bureau of Safety and Environmental Enforcement
1201 Elmwood Park Blvd (GE432A)
New Orleans, LA 70123

Attachment

Attachment

MOON POOL MONITORING Condition of Approval:

A moon pool has been identified during review of your plan submittal. The requirements below must be followed for any activities entailing use of the moon pool, except under circumstances when complying with these requirements would put the safety of the vessel or crew at risk. If any protected species (i.e. species protected under the Endangered Species Act [ESA] and/or Marine Mammal Protection Act [MMPA]) is detected in the moon pool, you are required to follow the appropriate procedures described in the *Reporting Requirements* condition of approval (COA) in your plan approval.

Application of these measures includes, but is not limited to, dive support vessels, service vessels, pipelaying vessels, drillships, floating platforms (e.g., SPAR), mobile offshore drilling units, and other facilities with enclosed moon pools (e.g., well in the hull of a vessel, with or without a door).

General Requirements

- Where the moon pools have hull doors, the operator(s) should keep the doors closed as much as reasonably practicable when no activity is occurring within the moon pool, unless the safety of crew or vessel require otherwise. This will prevent protected species from entering the confined area during periods of non-activity.
- Use of a moon pool requires regular monitoring while open to the water column and if a vessel is not underway. Regular monitoring means 24-hour video monitoring with hourly recurring checks for at least five minutes of the video feed, or hourly recurring visual checks of the moon pool for at least five minutes by a dedicated crew observer with no other tasks during that short visual check.
- If water conditions are such that observers are unable to see within a meter of the surface, operations requiring the lowering or retrieval of equipment through the moon pool must be conducted at a rate that will minimize potential harm to protected species.

Closure of the Hull Door

- Should the moon pool have a hull door that can be closed, then prior to and following closure, the moon pool must be monitored continuously by a dedicated crew observer with no other tasks to ensure that no individual protected species is present in the moon pool area. If visibility is not clear to the hull door from above (e.g., turbidity or low light), 30 minutes of monitoring is required prior to hull door closure.
- If a protected species is observed in the moon pool prior to closure of the hull door, the hull door must not be closed, except for human safety considerations. Once the observed animal leaves the moon pool, the operator may commence closure. If the

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observed animal remains in the moon pool after closure, contact NMFS or BSEE prior to the closure of the hull doors according to reporting requirements (see *Reporting Requirements* COA under *Reporting of Observations of Protected Species within an Enclosed Moon Pool*).

Movement of the Vessel (no hull door) and Equipment Deployment/Retrieval

- Prior to movement of the vessel and/or deployment/retrieval of equipment, the moon pool must be monitored continuously for a minimum of 30 minutes, by a dedicated crew observer with no other tasks, to ensure no individual protected species is present in the moon pool area.
- If a protected species is observed in the moon pool prior to movement of the vessel, the vessel must not be moved and equipment must not be deployed or retrieved, except for human safety considerations. If the observed animal leaves the moon pool, the operator may commence activities. If the observed animal remains in the moon pool contact BSEE prior to planned movement of the vessel according to reporting requirements (see *Reporting Requirements* COA under *Reporting of Observations of Protected Species within an Enclosed Moon Pool*.
- Should a protected species be observed in a moon pool prior to activity commencement (including lowering or retrieval of equipment), recovery of the animal or other actions specific to the scenario may be required to prevent interaction with the animal. If protected species are observed during activity, only reporting is required (see *Reporting Requirements* COA). Operators must not take such action except at the direction of, and after contact with, NMFS (see *Reporting Requirements* COA).

SLACK-LINE PRECAUTIONS Condition of Approval:

If operations require the use of flexible, small diameter (< 2 inch) lines to support operations (with or without divers), operators/contractors must reduce the slack in the lines, except for human safety considerations, to prevent accidental entanglement of protected species (i.e. species protected under the Endangered Species Act [ESA] and/or Marine Mammal Protection Act [MMPA]). This requirement includes tether lines attached to remotely operated equipment. The requirements below must be followed for any activities entailing use of flexible, small diameter lines that will not remain continuously taut, except when complying with these requirements would put the safety of divers, crew or the vessel at risk:

- Operators must utilize tensioning tools and/or other appropriate procedures to reduce unnecessary looseness in the lines and/or potential looping;
- The lines must remain taut, as long as additional safety risks are not created by this action;

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- A line tender must be present at all times during dive operations and must monitor the line(s) the entire time a diver is in the water; and
- Should the line tender and/or diver become aware of an entanglement of an individual protected species, the reporting requirements described in the *Reporting Requirements* COA must be followed as soon as safety permits.

REPORTING REQUIREMENTS Condition of Approval:

Review of your proposed activities identified use of equipment that has the potential for entanglement and/or entrapment of protected species (i.e. species protected under the Endangered Species Act [ESA] and/or Marine Mammal Protection Act [MMPA]) that could be present during operations. In case of entrapment, procedures and measures for reporting are dependent upon the situation at hand. **These requirements replace those specific to dead and injured species reporting in respective sections of Appendix A (insofar as they relate to geophysical surveys) and Appendix C of the 2020 Biological Opinion on the Bureau of Ocean Energy Management's Oil and Gas Program Activities in the Gulf of Mexico.**

*Incidents Requiring **Immediate** Reporting*

Certain scenarios or incidents require immediate reporting to Federal agencies; these are described below:

Should any of the following occur at any time, **immediate reporting** of the incident is required after personnel and/or diver safety is ensured:

- ○ Entanglement or entrapment of a protected species (i.e., an animal is entangled in a line or cannot or does not leave a moon pool of its own volition).
- ○ Injury of a protected species (e.g., the animal appears injured or lethargic).
- ○ Interaction, or contact with equipment by a protected species.
- ○ Any observation of a leatherback sea turtle within a moon pool (regardless of whether it appears injured, or an interaction with equipment or entanglement/entrapment is observed).

1. As soon as personnel and/or diver safety is ensured, report the incident to National Marine Fisheries Service (NMFS) by contacting the appropriate expert for 24-hr response. If you do not receive an immediate response, you must keep trying until contact is made. Any failed attempts should be documented. Contact information for reporting is as follows:
    a. **Marine mammals**: contact **Southeast Region's Marine Mammal Stranding Hotline at 1-877-433-8299**.
    b. **Sea turtles**: contact **Brian Stacy, Veterinary Medical Officer at 352-283-3370.** If unable to reach Brian Stacy, contact Lyndsey Howell at (301) 301-3061. This includes the immediate reporting of **any observation of a leatherback sea turtle within a moon pool**.
    c. **Other protected species** (e.g., giant manta ray, oceanic whitetip shark, or Gulf sturgeon)**:** contact the **ESA Section 7 biologist at 301-427-8413**

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(nmfs.psoreview@noaa.gov) and report all incidents to takereport.nmfsser@noaa.gov.

d. Minimum reporting information is described below:
    i. Time, date, water depth, and location (latitude/longitude) of the first discovery of the animal;
    ii. Name, type, and call sign of the vessel in which the event occurred;
    iii. Equipment being utilized at time of observation;
    iv. Species identification (if known) or description of the animal involved;
    v. Approximate size of animal;
    vi. Condition of the animal during the event and any observed injury / behavior;
    vii. Photographs or video footage of the animal, only if able; and
    viii. General narrative and timeline describing the events that took place.

2. After the appropriate contact(s) have been made for guidance/assistance as described in 1 above, you may call BSEE at 985-722-7902 (24 hours/day) for questions or additional guidance on recovery assistance needs (if still required) and continued monitoring requirements. You may also contact this number if you do not receive a timely response from the appropriate contact(s) listed in 1. above.
    a. Minimum post-incident reporting includes all information described above (under 1.d.i-viii) in addition to the following:
        i. NMFS liaison or stranding hotline that was contacted for assistance;
        ii. For moon pool observations or interactions:
        iii. Size and location of moon pool within vessel (e.g., hull door or no hull door);
        iv. Whether activities in the moon pool were halted or changed upon observation of the animal; and
        v. Whether the animal remains in the pool at the time of the report, or if not, the time/date the animal was last observed.

Reporting of Observations of Protected Species within an Enclosed Moon Pool

If a protected species is observed within an enclosed moon pool and does not demonstrate any signs of distress or injury or an inability to leave the moon pool of its own volition, measures described in this section must be followed (only in cases where they do not jeopardize human safety). Although this particular situation may not require immediate assistance and reporting as described under *Incidents Requiring Immediate Reporting* (see above), a protected species could potentially become disoriented with their surroundings and may not be able to leave the enclosed moon pool of their own volition. In order for operations requiring use of a moon pool to continue, the following reporting measures must be followed:

Within 24 hours of any observation, and daily after that for as long as an individual protected species remains within a moon pool (i.e., in cases where an ESA listed species has

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entered a moon pool but entrapment or injury has not been observed), the following information must be reported to BSEE (protectedspecies@bsee.gov):

1. For an initial report, all information described under 1.d.i-viii above should be included.
2. For subsequent daily reports:
    a. Describe the animal's status to include external body condition (e.g., note any injuries or noticeable features), behaviors (e.g., floating at surface, chasing fish, diving, lethargic, etc.), and movement (e.g., has the animal left the moon pool and returned on multiple occasions?);
    b. Description of current moon pool activities, if the animal is in the moon pool (e.g., drilling, preparation for demobilization, etc.);
    c. Description of planned activities in the immediate future related to vessel movement or deployment of equipment;
    d. Any additional photographs or video footage of the animal, if possible;
    e. Guidance received and followed from NMFS liaison or stranding hotline that was contacted for assistance;
    f. Whether activities in the moon pool were halted or changed upon observation of the animal; and
    g. Whether the animal remains in the pool at the time of the report, or if not, the time/date the animal was last observed.

United States Department of the Interior
BUREAU OF OCEAN ENERGY MANAGEMENT
New Orleans Office
1201 Elmwood Park Blvd
New Orleans, Louisiana 70123-2394

In Reply Refer To: GM 673E

Mr. Joseph Ranson, Field Supervisor
U.S. Fish and Wildlife Service
Louisiana Ecological Services
200 Dulles Drive
Lafayette, Louisiana 70506
joseph_ranson@fws.gov

Via Electronic Mail

Dear Mr. Ranson:

Pursuant to the Biological Opinion (BiOp) dated April 20, 2018, the Bureau of Ocean Energy Management's (BOEM) and Bureau of Safety and Environmental Enforcement's (BSEE) are requesting concurrence with our determination of the effect of proposed oil and gas leasing, exploration, development, production, decommissioning, and all related activities in the Gulf of Mexico Outer Continental Shelf (OCS) within existing leased areas and those areas proposed for future leasing in the Western Planning Area, the Central Planning Area, and the Eastern Planning Area on the newly designed threatened eastern black rail (*Laterallus jamaicensis jamaicensis*). The BiOp is for a ten-year period and any future consultations for this action may not warrant formal consultation and could be handled informally dependent upon the likelihood of take. The listing of a new species was identified as a potential trigger for reinitiation.

On October 8, 2020, a Final Rule was published that listed the eastern black rail as threatened with no critical habitat. The rule became effective on November 9, 2020. Attached is the BOEM evaluation regarding the potential effects from the OCS oil- and gas-related activities on the eastern black rail. Based on our evaluation, OCS oil and gas activities would have no effect or would be not likely to adversely affect the eastern black rail except in the case of a low-probability catastrophic spill, which is not reasonably certain to occur. Since a low-probability spill is not reasonably certain to occur, this type of spill has not been evaluated as either a direct or an indirect effect of the proposed action. As such, BOEM and BSEE have determined that the effects of the proposed action are not likely to jeopardize the continued existence of the eastern black rail.

If you have any questions regarding the above information or need any additional information for clarification, please do not hesitate to contact Dr. Tre Glenn at (504) 736-1749 or tre.glenn@boem.gov, and Mr. Daniel Leedy at (504) 736-2597 or daniel.leedy@bsee.gov.

Sincerely,

AGATHA-MARIE KALLER

Digitally signed by AGATHA-MARIE KALLER
DN: c=US, o=U.S. Government, ou=Department of the Interior, ou=Bureau of Ocean Energy Management, cn=AGATHA-MARIE KALLER, 0.9.2342.19200300.100.1.1=14001001248643
Date: 2021.02.12 06:41:16 -06'00'

Arie Kaller
Supervisor, Office of Environment
BOEM, Gulf of Mexico OCS Region

cc: Ms. Brigette Firmin, brigette_firmin@fws.gov
Mr. Joe Hodges, joe_hodges@fws.gov
Mr. T.J. Broussard, t.j.broussard@boem.gov

Enclosure:

Eastern Black Rail

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1. Species Description

In April 2010 the US Fish & Wildlife Service (FWS) received a petition to list 404 aquatic, riparian, and wetland species from the southeastern U.S., which included the eastern black rail (*Laterallus jamaicensis jamaicensis*). On September 27, 2011, the FWS published a 90-day finding on 374 of the petitioned species, including the eastern black rail, indicating that listing may be warranted (Federal Register 2011). On October 9, 2018 the FWS proposed to list the eastern black rail as threatened (Federal Register 2018). A final rule to the listing of the eastern black rail was published on October 8, 2020, with an effective date of November 9, 2020 (Federal Register, 2020). There is currently no critical habitat established for eastern black rail (USFWS, 2020). The eastern black rail (*Laterallus jamaicensis jamaicensis*) is protected under the Migratory Bird Treaty Act (USFWS, 2013).

The eastern black rail is a subspecies of the black rail and is a small and cryptic wetland dependent subspecies. The eastern black rail relies on salt, brackish, and freshwater marsh habitats that can be tidally or non-tidally influenced (Federal Register, 2018). Within these habitats the birds use the transition zone between the emergent wetlands and the upland interface (Federal Register, 2020) vegetated by emergent plants, including rushes, grasses, and sedges. The eastern black rail requires dense vegetative cover, made up of fine-stemmed emergent plants that form a dense canopy or cover. If scrub densities become too high, the habitat may become unsuitable. The eastern black rail uses areas of moist or flooded soils with, or adjacent to, very shallow waters (<6 centimeters). The eastern black rail forages on small aquatic and terrestrial invertebrates, especially insects and seeds (USFWS, 2018).

Historically, the eastern black rail was widely distributed in the eastern United States, Mexico, Central America, and the Caribbean in both inland and coastal areas. However, the distribution of the eastern black rail in New England, the Appalachian, and Central Lowlands has effectively been eliminated. Some populations remain in both inland and coastal areas within the Mid-Atlantic Coastal Plain, Southeast Coastal Plain, Southwest Coastal Plain and Great Plains. Current information suggests that there are two populations in the south-central U.S: one migratory population breeds in Colorado and Kansas then winters in Texas; the second non-migratory population lives in Texas year-round. A third population occurs in the U.S. Atlantic coast and is suspected to migrate and winter on the southern Atlantic coast and in the Caribbean and Central America (Federal Register, 2018). Migration of the eastern black rail is poorly understood. Within the Gulf of Mexico region, wintering and resident birds are found primarily along the Texas Coast, the western Louisiana Coast, and the Gulf Coast of Florida (Federal Register, 2018; USFWS, 2018). Eastern black rail sightings in the other Gulf Coast states would be considered a vagrant or as an accidental migrant.

Based on the best available data, there are currently no precise population estimates for this subspecies. However, over the past 10 to 20 years, the U.S. population has experienced declines of 75% or greater. In 2017, pre-Hurricane Harvey, population estimates along the upper Texas coast were estimated at 1,299 individuals (USFWS, 2018). The upper Texas coast was significantly impacted by flooding from Hurricane Harvey and the eastern black rail are expected to have experienced population declines from such impacts. Between 355 and 815 breeding pairs are estimated to reflect the Atlantic Coast and Florida Atlantic and Gulf Coast populations

(USFWS, 2018). Again, those areas were impacted by multiple hurricane events after those estimates.

2. Environmental Baseline Factors

The oil from the *Deepwater Horizon* (DWH) event has had serious direct and indirect impacts to coastal and marine birds, and such effects were far more serious for birds using the Central Planning Area (CPA) than the Western Planning Area (WPA), because the extent of the spill remained east of the WPA boundary. At this time, it is unknown what the long-term impacts are to respective species populations. Data are lacking on spatial and temporal aspects of search effort, and, more important, data on sex-age composition of the collected sample. Sex-age composition data would be beneficial because they provide insights into the short- and long-term impacts for a given avian species, as well as information necessary to gauge a species' recovery potential. It is reasonable to infer from the limited data available that not all species groups were impacted similarly and that not all species within a group were impacted similarly. There may be delayed effects for some species due to major impacts to certain year classes (i.e., subadults), such that the impacts will not be realized until the dead individuals would have attained breeding age. Individual life-history strategies, starting population size and trajectory, and sex and age composition of the population before the DWH event will ultimately dictate the impacts at the population level. It should also be noted that the total body count and the total modeled estimate of avian mortality from an oil spill is a poor indicator of "effect" or "impact" to a given species' population, because not all birds are of equal reproductive value to the population (i.e., reproductive age females are "worth" more to the population). To address this, some form of calculating and/or deriving lost bird-years and recovery to baseline conditions is necessary and requires knowledge of the age-sex composition of the oiled sample of birds, as well as age-sex structure of the target population (Multisale EIS-USDOI, BOEM, 2012a-c).

Unavailable information on the effects to coastal and marine birds from the DWH event (and thus changes to the avian baseline in the affected environment) makes an understanding of the potential impacts from the Outer Continental Shelf (OCS) oil and gas activities less clear. Relevant data on the status of bird populations after the DWH event may take years to acquire and analyze through the Natural Resource Damage Assessment (NRDA) process, and impacts from the DWH event may be difficult or impossible to discern from other factors.

For Endangered Species Act (ESA) purposes, the Bureau of Ocean Energy Management (BOEM) and the Bureau of Safety and Environmental Enforcement (BSEE) continue to maintain that a low-probability catastrophic spill is neither a direct nor an indirect effect of the proposed action. A low-probability catastrophic spill is, by definition, not reasonably certain to occur. The National Marine Fisheries Service (NMFS) indicate that under their ESA guidance they may also consider the risk of a catastrophic event discountable as it may have adverse effects but a very low risk occurrence; regardless, the Bureaus believe that a future catastrophic spill is not reasonably certain to occur, as the risk is exceedingly low, particularly after the implementation of new safety measures and advances in containment technologies after the DWH event. The Bureaus do, however, recognize FWS's interest in considering this type of event for informational purposes. The information and analyses that BOEM has provided, as part of this consultation, is information based on the best available information as required under ESA and by BOEM expert opinion. Other methods of analysis are significantly limited in their applicability and availability, nor would they provide any meaningful or useful information to be used to assess risk of catastrophic spill occurrence at this programmatic level of oil and gas activities in the Gulf of Mexico. While the Bureaus acknowledge that, even with the most stringent standards, risk can never be wholly eliminated, they believe that the risk of a catastrophic spill, which was small even before the DWH spill, has been further reduced with the development of this suite of safety protocols, regulations, and new technologies. The Bureaus believe, with a high level of confidence, that a catastrophic oil spill is now even less likely to occur during the consultation period of this proposed action (see Appendix L in the Biological Assessment).

3. Routine Activities

3.1 Major Factors

The possible effects of routine activities on eastern black rail along the Gulf of Mexico are discussed below.

- habitat loss and fragmentation;
- behavioral effects due primarily to disturbance from OCS helicopter and service-vessel traffic and associated noise;
- mortality due to exposure and intake of OCS-related contaminants, e.g., produced waters and discarded debris; and
- sublethal, chronic effects from air emissions.

3.1.1 Habitat Loss and Fragmentation

The greatest negative impact to coastal and marine birds is the loss, alteration, and fragmentation of preferred or critical habitat (Fahrig, 1997 and 1998). This is particularly true for threatened and/or endangered species, whereby populations tend to be at or approaching some critical threshold in abundance (Dennis et al., 1991; Belovsky et al., 1994).

Pipeline landfalls, terminals, and other onshore OCS-related infrastructure can destroy or fragment otherwise suitable avian habitats (e.g., wetlands), resulting in the displacement of associated avian communities. Seabird nesting colonies are particularly sensitive to disturbance and habitat alteration or loss, and known colonies should always be avoided by construction activities. Environmental regulations (Section 404 of the Clean Water Act, U.S. Dept. of the Army Corps of Engineers) require restoration (or mitigation) of wetlands modified (e.g., drain, fill, dredge) or destroyed by pipe laying barges and associated onshore infrastructure. However, onshore pipelines cross a wide variety of coastal environments and can affect certain species often not associated with freshwater, marine, or estuarine systems.

Fidelity to coastal and marine roosting, nesting, and foraging sites likely varies among species and within and among years for a given species along the Gulf Coast. Site abandonment along the northern Gulf Coast has often been attributed primarily to habitat loss and fragmentation, and also to excessive human disturbance (Visser et al., 2005; LeDee et al., 2008). Many of the overwintering shorebird species remain within relatively well-defined, winter-use areas throughout the season, and some species exhibit among-year wintering site fidelity, at least when not disturbed by humans (Drake et al., 2001). These species are particularly vulnerable to localized impacts resulting in habitat loss or fragmentation unless they disperse to more favorable habitats when disturbed. This assumes that such habitats are available, in proximity to, and are of similar or greater quality compared with the disturbed habitat (Block and Brennan, 1993; Johnson, 2005).

Eastern black rails are considered both resident and migratory to the Texas Coast and migratory to the Florida Gulf Coast (Federal Register 2018). Because of the eastern black rail's use of the specific transition zone between wetlands and uplands and their specific vegetative needs (Tolliver, 2017), their ability to relocate to suitable habitat may be less likely than other wading bird species. These habitat types have experienced significant declines, with some areas in the eastern black rail's historical range losing over 90% of their prairie habitat (Sampson and Knopf, 1994). The displacement into the secondary selected habitat may be of lesser quality, resulting in reduced survival and reproduction (Knutson et al., 2006).

Birds may relocate from an impacted habitat to an alternative habitat, but several factors may affect this ability and success (Boulinier and Lemel, 1996). However, the newly-occupied habitat may be of lesser quality, resulting in reduced survival and reproduction (Knutson et al., 2006). This may have short-term or long-term implications, depending on the species (Battin, 2004). In their study of non-OCS oil and gas development at Padre Island National Seashore in Texas, Lawson et al. (2011) documented declines in abundance of several species of wintering passerines with decreasing distance from roads. However, the authors did not detect a difference in abundance among active drilling sites, active pumping stations, abandoned well sites, or roads (Lawson et al., 2011, Figure 1).

3.1.2 Helicopter and Vessel Traffic

Disturbance effects related to OCS activities (e.g., air and vessel traffic) can have variable impacts to avian populations depending on the type, intensity, frequency, duration, and distance to the disturbance source (Bélanger and Bédard, 1989; Conomy et al., 1998; Blumstein, 2003). For birds, hearing sensitivity seems most acute in the range of 1–5 kHz, similar to the most sensitive mammals in this range; above and below that range, avian performance appears to be inferior (Manci et al., 1988, p. 32). Birds vocalize as a form of communication for predator detection-avoidance, food-finding, and migration. More important, for many avian species, aural communication (i.e., calls or songs) is used for locating mates, determining mate quality, and maintaining pair bonds (Welty and Baptista, 1988). Anthropogenic sound (i.e., noise pollution) may mask or otherwise interfere with avian communication (Bayne and Dale, 2011). Disturbance-related impacts do not typically result in direct mortality. Rather, effects tend to manifest themselves through the following:

- behavioral changes (Bélanger and Bédard, 1990);
- reduced pairing success (Habib et al., 2007);
- selection of alternative habitats that may be suboptimal;
- creating barriers to movement or decreasing available habitat (Bayne et al., 2005a and 2005b);
- decreases in foraging time (Verhulst et al., 2001);
- reduced foraging efficiency;
- reduced time spent resting or preening (Tarr et al., 2010);
- prey switching;
- increases in energy expenditures due to flight behavior and temporary displacement (compared to resting, preening, or foraging) (Platteeuw and Henkens, 1997; Ackerman et al., 2004); and
- possible decreases in reproductive effort or nest success (Béchet et al., 2004; McGowan and Simons, 2006).

Overall, the literature reviewed suggests negative short- and long-term disturbance effects to birds (Carney and Sydeman, 1999).

Noise, with particular reference to military aircraft as a disturbance factor, has been previously reviewed by Larkin et al. (1996), Gutzwiller and Hayden (1997), and Efroymson et al. (2000). Helicopters appear to exert a greater influence on avian behavior (flight initiation distance, duration in flight, and distance flown) than airplanes, which is likely due to the much higher decibel level associated with the prop wash (Ward et al., 1994 and 1999). Komenda-Zehnder et al. (2003, p. 10) recommended minimum flight altitudes (above sea level) of 450 m (1,476 ft) for helicopters and 300 m (984 ft) for airplanes, based on results for disturbance to wintering waterbirds (mostly ducks). In the Gulf of Mexico, all aircraft are required to follow the Federal Aviation Administration's Advisory Circular 91-36C (1984) minimum altitude of 610 m (2,000 ft). This requirement is not tracked and it is likely that some of the helicopters departing from onshore sites to offshore platforms fly below the Federal Aviation Administration's minimum in areas of high bird density (e.g., waterbird colonies, beach-nesting bird colonies, and National Wildlife Refuges) to reduce total travel time or reduce fuel consumption, and during periods of inclement weather, high winds, or low ceilings. Although helicopter traffic in support of offshore oil and gas activities is anticipated to occur frequently, such disturbances tend to be relatively short in duration.

3.1.3 Air Emissions

In North America, there is a dearth of information concerning potential impacts of air pollution on birds, other than effects related to acid rain (Hames et al., 2002; Rimmer et al., 2005). In his review of air pollution impacts on wildlife, Newman (1979) stated that information was too limited to draw conclusions regarding species sensitivity.

Sources of air pollution on the OCS in support of routine activities include the following:

1. service support vessels, i.e., boats, ships, etc.;
2. helicopters;
3. generators and other related gas- or diesel-powered engines on platforms;
4. flaring; and
5. other equipment on platforms (i.e., vents, fugitives, glycol dehydrators, pneumatic pumps, and pressure level controllers, boilers, heaters, and burners).

In their Gulfwide inventory of emissions from platforms, Wilson et al. (2010) documented a 19 percent increase (up over 9,000 tons since previous inventory) in volatile organic compounds (VOCs), and the overall activity of flaring increased. For more details about the list of OCS-related emission sources, the types of pollutants monitored, and total platform emission estimates, refer to Wilson et al. (2010, Table 8-1).

It is well known that the myriad constituents of air pollution (e.g., As, Cd, Se, H_2S, NO_x, CO, CO_2, CH_4, O_3 [ozone], Pb, Hg, MeHg, Fl, Al, SO_2, PAH's, chlorofluorocarbons, hydrochlorofluorocarbons, particulate matter [PM], and fly ash) may be harmful to wildlife (Newman and Schreiber, 1988; Schreiber and Newman, 1988) and humans. These and other pollutants are regulated onshore by the U.S. Environmental Protection Agency (USEPA) under the Clean Air Act (CAA) of 1970 and subsequent provisions. Under provisions of the CAA Amendments of 1990, the USEPA Administrator has jurisdiction in OCS areas eastward of 87.5°W longitude in the Gulf of Mexico and, in consultation with the Secretary of the Interior and the Commandant of the U.S. Coast Guard, established the requirements to control air pollution in that area of the Gulf. Effects of air pollutants on birds can result in major die-offs or effects can be relatively subtle including behavioral changes; changes in distribution and habitat use; increased susceptibility to parasites, diseases, and infections; physiological and respiratory stress; and anemia (Newman, 1979; Newman and Schreiber, 1988; Eeva et al., 1994). According to Newman and Schreiber (1988), the low number of reported incidents involving wildlife is likely a function of lack of awareness and recognition of the problem rather than a low incidence of occurrence (Newman and Schreiber, 1988, Tables 1-2). Air pollution may result in changes to avian populations through their distribution or abundance, but it may be difficult to separate emission-related effects from other population-limiting factors (i.e., food limitation, change in distribution of preferred foods, weather-related effects to habitats, or anthropogenic impacts to habitats, etc.) and their interactions (Schreiber and Newman, 1988, p. 350). In addition, cross-seasonal effects or annual variation in recruitment or mortality may be occurring in other regions (e.g., food shortage on the wintering grounds or on staging areas, major mortality event during migration [Newton 2006 and 2007]), masking air pollution effects or making it more difficult to discern such effects.

Recovery potential for a species or its ability to withstand additional population-level losses due to anthropogenic impacts, including air pollution, is largely a function of its life-history strategy (Sæther and Bakke, 2000; Sæther et al., 2004). It is likely that birds using the CPA would encounter greater levels of air pollution than birds using the WPA or Eastern Planning Area (EPA) due to (1) greater number of platforms and more flaring from platforms at a given point-in-time in the CPA than WPA, (2) greater number of total vessel trips in the CPA than WPA, and (3) greater number of helicopter support trips in the CPA than WPA (see the "OCS oil and gas activities Analysis" section below). Therefore, total air pollution associated with CPA OCS oil and gas activities would likely be greater in the CPA than in the WPA (Wilson et al., 2010). This does not consider between-area differences in prevailing winds, differences in associated infrastructure onshore, or other sources of inputs onshore.

There are very few studies assessing contaminants' effects on black rails (Eddleman et al. 1994), despite the fact that contaminants' impacts on waterbirds have long been studied. One concern specific to eastern black rails is the wide-spread use of pesticides to control mosquito marsh populations (Morris et al., 2005; Poulin et al., 2010; Lagadic et al., 2014), but the importance of mosquitoes to the eastern black rail's diet is currently unknown. Overall, according to the FWS, there is no evidence of specific contaminant threats to the eastern black rail that could impact the subspecies at a population level (U.S. Fish and Wildlife Service, 2018).

3.1.4 Produced Water

Produced water impacts on birds can vary from short term to long term and from sublethal to lethal. Produced water has previously received limited attention relative to potential effects to birds using offshore waters or as a chronic source of pollution (Stephenson, 1997; Wiese et al., 2001). The reasons are based on the following assumptions:

1. the regulatory limits established by USEPA eliminate or significantly reduce the potential for negative effects to birds; and
2. produced water and its constituent pollutants will be diluted simply as a function of the dilution potential of the ocean, eliminating or minimizing potential harm to birds.

Produced water, including its constituent pollutants, is the largest waste stream associated with oil and gas production (Veil et al., 2004; Welch and Rychel, 2004). The volume of produced water is not constant over time and increases over the life of an individual well (Veil et al., 2004). It has been estimated that U.S. wells produce 7 bbl of produced water for every barrel of oil and may comprise as much as 98 percent of the material brought to the surface for wells nearing the end of productivity (Veil et al., 2004). Produced water is composed of a number of different substances, including trace heavy metals, radionuclides, sulfates, treatment chemicals, produced solids, and hydrocarbons (see Veil et al., 2004, Table 2-1, for a complete list of substances and amounts from Gulf of Mexico wells). Pollutants discharged into navigable waters of the U.S. are regulated by USEPA under the Clean Water Act of 1972 and subsequent provisions (33 U.S.C. §1251 et seq.). Specifically, a NPDES permit must be obtained from USEPA under Sections 301(h) and 403 (45 FR 65953, October 3, 1980) of the Clean Water Act. However, not all water pollutants are regulated or are regulated at levels that will prevent effects to wildlife, including birds (Fraser et al., 2006, pp. 148–150).

Impacts to birds from pollutants remaining in produced water may be from ingestion, contact (direct), or from the changes in the abundance, distribution, or composition of preferred foods (indirect). O'Hara and Morandin (2010) documented measurable oil transfer to feathers and impacts to feather microstructure at sheen thickness as low as 0.1–0.3 micrometer. A light coating of hydrocarbons and other substances found in produced water is enough to negatively affect feather microstructure, potentially compromising its buoyancy, insulation (i.e., thermoregulatory function and capacity), and flight characteristics (Stephenson, 1997; O'Hara and Morandin, 2010).

3.1.5 Marine Debris

Ingestion or entanglement with plastic materials may lead to injury or death. The effects of plastic ingestion may be long-term and may include physical deterioration due to malnutrition; plastic material cannot digest often leading to a distention of the stomach, thus preventing its contraction and simulating a sense of satiation (Moser and Lee, 1992; Pierce et al., 2004). The chemical toxicity of some plastics can be high, posing a hazard in addition to obstruction and impaction of the gut (Fry et al., 1987). Some birds also feed plastic debris to their young, which could reduce fledging success and offspring survival rates. As a result of stress from the consumption of debris, individuals may weaken, facilitating infection and disease; migratory species may then not have the energetic capacity to initiate migration or complete the migration process. The Notice to Lesee (NTL) 2012-BSEE-G01, issued on January 1, 2012, applied to activities permitted before March 13, 2020 and provides standards for marine trash and debris awareness and elimination. On March 13, 2020, updated guidance was provided under Appendix B of the Biological Opinion issued by NMFS. The Gulf of Mexico Marine Trash and Debris Awareness and Elimination Survey Protocols can be accessed on the NOAA Fisheries website (https://www.fisheries.noaa.gov/resource/document/appendices-biological-opinion-federally-regulated-oil-and-gas-program-gulf-mexico). The updated guidance provides standards for activities permitted after March 13, 2020.

3.1.6 OCS Oil and Gas Activities

The routine activities are discussed below and are expected to be of short duration and limited in scope.

3.1.6.1 Vessel and Air Traffic

Service vessels would use selected nearshore and coastal (inland) navigation waterways, or corridors, and should adhere to regulations set forth by the U.S. Coast Guard (USCG) for reduced vessel speeds within these inland areas. The effects would be limited to the immediate vicinity of the vessel and would be of short duration. Impacts are expected to "not likely to adversely affect" this species.

The Federal Aviation Administration and corporate helicopter policy advise helicopters to maintain a minimum altitude of 700 ft (213 m) while in transit offshore and 500 ft (152 m) while working between platforms. When flying over land, the specified minimum altitude is 1,000 ft (305 m) over unpopulated areas or across coastlines and 2,000 ft (610 m) over populated areas and biologically sensitive areas such as National Wildlife Refuges and National Parks. Many relatively undisturbed coastal areas and refuges provide preferred and/or critical habitat for feeding, resting (or staging), and nesting birds. The effects are expected to be of short duration and limited in scope. Impacts from helicopter flights associated with routine activities are expected to "not likely to adversely affect" this species.

Overall, the predicted scenario statistics suggest a far greater number of exploration and production wells, more installed structures, far greater length of installed pipelines, and much higher level of support related activities in the CPA compared with the WPA or EPA.

3.1.6.2 Air Pollution

Emissions of pollutants into the atmosphere from the activities associated with CPA OCS oil and gas activities should result in minimal effects on offshore and onshore air quality because of the prevailing atmospheric conditions, emission heights and rates, and pollutant concentrations. The most likely pathway for air pollution to affect birds is through acidification of inland waterbodies and soils, and a subsequent change in trophic structure (White and Wilds, 1998; USDOC, NOAA, 2011a). Even though the levels of activity are much greater in the CPA compared with the WPA or EPA, impacts to birds from decreased air quality due to routine activities are expected to be negligible because air quality impacts from CPA OCS oil and gas activities are unlikely to impact ambient air quality (but see Wilson et al., 2010).

3.1.6.3 Produced Water

Produced water is an operational discharge containing hydrocarbons, trace heavy metals, radionuclides, sulfates, treatment chemicals, and produced solids that represents most of the waste discharged from offshore oil extraction production facilities (Veil et al., 2004; Welch and Rychel, 2004). The degradation of coastal and estuarine water quality expected to result from of OCS-related discharges, particularly when added to existing degradation from other sources, may affect coastal birds directly by means of acute or chronic toxic effects from ingestion or contact, or indirectly through the contamination of food sources or habitat loss and/or degradation (Fraser et al., 2006). Operational discharges or runoff in the offshore environment could also affect seabirds that remain and feed in the vicinity of offshore OCS structures and platforms (Wiese et al., 2001; Burke et al., 2005). These impacts could also be both direct and indirect. Many seabirds feed and nest in the Gulf; therefore, water quality may also affect breeding success (measured as the ratio of fledged birds per nest to hatched birds per nest). The NPDES permit maximum allowable oil and grease concentration is an average of 29 mg/L per month for the OCS and specifies a maximum (daily average) of 42mg/L daily, which are events that may cause sheens (Fraser et al., 2006, p. 149). However, the permittee is required to monitor free oil using the visual sheen test method on the surface of the receiving water. Monitoring is performed once per day when discharging, during conditions when observation of a sheen on the surface of the receiving water is possible in the vicinity of the discharge, and when the facility is manned. It is unlawful to discharge produced water that causes a visible sheen. Impacts from produced-water discharges associated with routine activities are expected to "not likely to adversely affect" this species.

3.1.6.4 Habitat Loss and Fragmentation

The analysis of the potential impacts to coastal environments (**Chapters 3.1.2.1 and 4.2.1.3**) concludes that WPA, CPA, or EPA OCS oil and gas activities are not expected to adversely alter barrier beach configurations beyond existing, ongoing impacts in localized areas downdrift of artificially jettied and maintained channels. Adverse impacts of pipeline and navigation canals are the most significant OCS-related and proposed-action-related impacts to wetlands that may be used by many species of birds. Initial impacts are locally significant and largely limited to where OCS-related canals and channels pass through wetlands.

3.1.6.5 Trash and Debris

Coastal and marine birds are susceptible to entanglement in floating, submerged, and beached marine debris, specifically in plastics discarded from both offshore sources and land-derived litter and waste disposal. It is believed that coastal and marine birds are less likely to become entangled in or ingest OCS-related trash and debris due to BSEE regulations that prohibit the disposal of equipment, containers, and other materials into offshore waters by lessees (30 CFR 250.300). Also, MARPOL, Annex V, Public Law 100-220 (101 Statute 1458), prohibits the disposal of any plastics, garbage, and other solid wastes at sea or in coastal waters (effective January 1, 1989, and enforced by USCG). The BSEE policy regarding marine debris prevention is outlined in NTL 2012-BSEE-G01 and Appendix B, Gulf of Mexico Marine Trash and Debris Awareness and Elimination Survey Protocols, found in the Biological Opinion issued by the NMFS on March 13, 2020. As such, impacts to birds from OCS-related trash and debris associated with routine activities are expected to be negligible.

4. Accidental Events

The following analysis includes information developed and incorporated in the wake of the DWH event (Oil Spill Commission, 2011b). Additional information on oil-spill impacts to birds and results from avian monitoring related to the DWH event can be found in **Chapter 4.1.1.14.1 of the Multisale EIS** (USDOI, BOEM, 2012b). A more detailed discussion of catastrophic oil-spill events can be found in **Appendix B**–but as noted above, BOEM does not consider a catastrophic event to be an effect of the OCS oil and gas activities as it is not reasonably certain to occur. Additional information regarding oil-spill occurrence, probabilities, and volumes for the Gulf of Mexico can be found in Anderson and Labelle (2000), and Oil Spill Commission (2011b).

These results and the reviews from the Oil Spill Commission (2011c, 2011d, and 2011e) suggest that oil-spill probabilities and estimates of spill size and frequency may be biased low, or at a minimum, impacts to infrastructure from hurricanes should also be considered as a variable when attempting to model oil spill-related parameters and associated risk (Stewart and Leschine, 1986; Pulsipher et al., 1998; Kaiser and Pulsipher, 2007). The BOEM has run a new OSRA catastrophic spill analysis included in the Multisale EIS, and the EPA FEIS.

Due to the aging infrastructure, particularly pipelines, spill-related risks or probabilities may not be constant over the life of the OCS oil and gas activities, especially in the event of hurricanes. This section discusses impacts to coastal and marine birds resulting from accidents reasonably certain to occur as associated with the OCS oil and gas activities. Impact-producing factors include oil spills and oil-spill cleanup activities, including the release of rehabilitated birds. As previously mentioned in **Chapters 4.1.1.14.1 and 4.1.1.14.2 of the Multisale EIS** (USDOI BOEM, 2012a–2012c), it is recognized that, due to either the small initial population size, the initial population trajectory, or both, for threatened and endangered avian species, any spill and associated cleanup activities would likely have a proportionately greater negative effect to the population (Dennis et al., 1991; Belovsky et al., 1994). With the DWH event, Congress and various Federal commissions have indicated potential interest in holding parties involved in accidental events that impact migratory birds responsible under the Migratory Bird Treaty Act (Alexander, 2010; Corn and Copeland, 2010).

4.1 Oil Spills and Response

Oil spills represent the greatest potential direct and indirect impact to coastal and marine bird populations. Birds that are heavily oiled succumb to acute toxicity effects shortly after exposure (Clark, 1984; Leighton, 1993). If the physical oiling of individuals or local flocks of birds occurs, some degree of both acute and chronic physiological stress associated with direct and secondary uptake of oil would be expected. Small coastal spills, pipeline spills, and spills from accidents in navigable waterways can contact and affect the different groups of coastal and marine birds, most commonly seabirds, divers, marsh- and wading birds, waterfowl, and some species of shorebirds (King and Sanger, 1979, Table 1; Williams et al., 1995, Table 5; Camphuysen, 2006, Table 6).

Lightly oiled birds can sustain tissue and organ damage from oil ingested during feeding and grooming or from oil that is inhaled. Birds that are heavily oiled usually die. Lighter polycyclic aromatic hydrocarbons (PAHs), like naphlalene and phenanthrene, are volatile and water-soluble, but they are somewhat more persistent compared with lighter, more volatile, and more water-soluble hydrocarbons like benzene (Albers, 2006). Low levels of oil may have multiple deleterious effects, including the following:

- changes in behavior;
- interference with feeding drive and food detection;
- alteration of food preferences and ability to discriminate between poor compared to ideal food items;
- predator detection and avoidance;
- definition and defense of breeding and feeding territories;
- kin recognition;
- weakening of pair bonds (Butler et al., 1988);
- changes in incubation behavior (Butler et al., 1988; Fry et al., 1986);
- reduced provisioning of nestlings and fledglings, leading to reduced growth and survival (Trivelpiece et al., 1984; Boersma et al., 1988); and
- alteration of homing ability and fidelity for highly philopatric species.

Residual material that remains after evaporation and solubilization are water-in-oil emulsions (mousse), which are the primary pollutant onshore after oil from offshore spills actually reaches land. The mixing of mousse and sediments form aggregates that have the odor of oil and, after photo- and biological oxidation, form asphaltic “tarballs” and pavements (Briggs et al., 1996). Mousse emulsions may be the most toxic petroleum component because they are the most hydrophobic and will penetrate the hydrophobic core of the plasma membrane of cells and will cause disruption of the membrane and enter the cells as well (Briggs et al., 1996 and 1997). Common symptoms of exposed birds include dehydration, gastrointestinal problems, infections, arthritis, pneumonia, hemolytic anemias, cloacal impaction, and eye irritation. Therefore, antibiotic treatments, nutritional support, rehydration, and other protocols are used at rehabilitation centers (Briggs et al., 1996 and 1997).

When oil gets into vegetated or unvegetated sediment, low redox potentials, absence of light, and waterlogged substrate may result in oil that can neither be oxidized by bacteria and sunlight nor evaporate. The oil may also remain in its unweathered toxic state indefinitely. However, weathering-related effects on the oil from its path offshore to the coast ameliorates, to some extent, toxicity at the shoreline.

The use of feeding areas at the sea surface and intertidal wetland zone, where spilled oil tends to accumulate, makes the waterbirds, shorebirds, and some species of seabirds vulnerable to exposure to oil (Dunnet, 1982). If physical oiling of individuals or local groups of birds occurs, some degree of both acute and chronic physiological stress associated with direct and secondary uptake of oil would be expected (Burger and Fry, 1993; Leighton, 1993). Affected individuals may initially appear healthy, but they may be affected by physiological stress that does not occur until much later. Biochemical impacts of lighter PAHs have not been extensively described but may include increased susceptibility to physiological disorders including disruption of homeostasis; weakened immune systems and reduced resistance to disease; and disruption of respiratory functions (Briggs et al., 1996). The physiology and biochemical network of a bird has many components, interactions, and functions that may provide potential points of attack from petrochemicals (Welty and Baptista, 1988). The network and internal feedback system also provide routes by which an effect on one process can lead to cascading sublethal, chronic effects in other systems (Burger and Fry, 1993; Albers, 2006).

Under natural conditions, water does not penetrate through the vanes of the feathers because air is present in the tiny pores in the lattice structure of the feather vane. Oil, with its reduced surface tension, and hydrophobic characteristics, adheres to keratin and mats the feather barbules into clumps; the lattice opens up (breaks down) and water penetrates and displaces insulating air (Lambert et al., 1982; O'Hara and Morandin, 2010). Oil also mats the feathers together, displacing insulating properties of trapped air (Jenssen, 1994). Dispersants also reduce water surface tension in the feather lattice pores (due to their surfactant component), and render them water-attracting instead of water-repelling (Stephenson, 1997; Stephenson and Andrews, 1997). Thus, at a certain surface tension, water will penetrate the feathers, and death from reduced thermoregulatory function may result (Lambert et al., 1982; Stephenson, 1997; Stephenson and Andrews, 1997). Birds that must feed on or in the water will lose heat faster than semiaquatic birds (e.g., wading- and shorebirds) that can feed with dry plumage on land (Jenssen, 1994).

Ingestion of oil by birds affects reproductive ability (Velando et al., 2005a and 2005b; Zabala et al., 2010). It may reduce eggshell thickness, resulting in eggs being cracked by incubating adults. Alonso-Alvarez et al. (2007a and 2007b) used blood chemistry of yellow-legged gulls (*Larus michahellis*) to compare long-term sublethal toxicity of the *Prestige* oil spill with short-term experimental sublethal toxicity in captive birds fed small amounts of fuel oil. Long-term effects were measured about 19 months after the spill. Short-term effects were measured in captive birds fed a small amount of fuel oil for 7 days. Adults from oiled colonies and fuel-oil-fed experimental birds had higher total PAHs and lower levels of three natural metabolites. Calcium was lower in oil-fed females than in control females, but it was the same in oil-fed and control males. Calcium is critical to females during follicular development because it is used for production of the egg shell. Ingestion of oil may alter liver enzyme function, osmoregulatory function, adrenocortical processes, and corticosteroid levels, and it may cause anemia (Lambert et al., 1982; Rocke et al., 1984; Pérez et al., 2010). Burger (1997) reported that exposure to small amounts of oil reduces immune response to diseases or results in decreases in body mass such that impacts may not be documented for many years or until oiled birds face additional environmental stressors, at which time exposed birds tend to experience higher levels of mortality compared with unexposed birds.

External oiling of eggs can slow embryonic growth, induce tumor growth, reduce gas conductance through the eggshell, and decrease hatchability (Jenssen, 1994). Impacts on vital life-history characteristics such as growth rates (Szaro et al., 1978a and 1978b; Trivelpiece et al., 1984) or reproductive parameters such as reproductive success can occur, resulting in possible local population extinction. Indirect effects occur by fouling of nesting habitat and by displacement of individuals, breeding pairs, or populations to less favorable habitats; changes in preferred prey abundance and distribution have also been documented (Esler et al., 2002; Golet et al., 2002; Velando et al., 2005b). Competition from con- and hetero-specifics may prevent displaced birds from accessing and occupying unoiled or undisturbed habitats, particularly for seabird colonies in southeastern Louisiana.

Oil spill response activities along the shore may disturb nesting populations of birds and reduce the suitability of the habitat due to air, vehicle, and foot traffic. The operation may use personnel with varied experience or training that can contribute to such impacts.

In general, research on long-term survival and reproduction of rehabilitated, oiled birds is limited, and results to date are mixed (Anderson et al., 1996; Sharp, 1996; Anderson and Labelle, 2000; but see Golightly et al., 2002; Mazet et al., 2002; Underhill et al., 1999). Success of rehabilitation for oiled birds may be a function of capture and handling methods, overall oiling and exposure of the individual, facility design, and availability of food, water, and space while in captivity, as well as species-specific characteristics, including body size, metabolism, and resting-heart-rate. It is critical that rehabilitated birds remain disease-free while in captivity. A major concern for holding wild animals, including birds, in facilities post-spill is the potential to expose the wild population to diseases once rehabilitated individuals are released. In some cases, the loss from disease could equal or exceed losses due to oil contamination. The efficacy of rehabilitation of birds after an oil spill remains a contentious and unresolved issue among avian ecologists and the scientific community alike (Estes, 1998; Jessup and Mazet, 1999).

Timing (i.e., if peak periods in bird density overlap temporally with the spill; Fraser et al., 2006), location (high compared to low bird density area), wind conditions, wave action, and distance to the shore may have a greater overall effect on bird mortality than spill volume and fluid type (Wilhelm et al., 2007; Castège et al., 2007; Byrd et al., 2009). *Exxon Valdez* spilled only about 10.8 million gallons, but it killed about 100,000–300,000 birds (Piatt et al., 1990a and 1990b; Piatt and Ford, 1996). The sea state at the time of the *Exxon Valdez* accident was relatively calm, and the oil was heavy, high-viscosity crude, resulting in little capability for chemical treatment or natural dispersal, breakdown, and weathering. Because of its undispersed state, the *Exxon Valdez* oil affected principally surface-dwelling and shore-dwelling organisms, such as birds. As oil weathered, the exposure of seabirds to oil from the *Exxon Valdez* spill shifted from direct oiling to ingestion of oil with prey or of contaminated prey (Piatt and Anderson, 1996; Seiser et al., 2000; Golet et al., 2002; Esler et al., 2010; but see also Wiens et al., 2001 and 2004). For a long-term review of the ecosystem following the *Exxon Valdez* spill, refer to Peterson et al. (2003).

Parsons (1994) provides the following unique before–after data for impacts of a spill on birds. Extensive shoreline and salt marsh were oiled by a January 1990 Exxon spill in the Arthur Kill and Kill van Kull estuaries of New York Harbor. Double-crested cormorants had achieved their maximum population growth by 1991. Productivity of herring gulls remained unchanged by the spill. Most heron populations increased after the spill. The greater black-backed gull population declined. Snowy egrets and glossy ibis used salt marsh and mud flat habitat, some of which was oiled. Black-crowned night heron and glossy ibis had delayed nesting after the spill and, along with snowy egret, showed lower reproductive success after the spill. Reproductive parameters like egg laying and hatching were generally higher than during the chick-rearing period, likely attributable to reduced food availability for provisioning chicks. Waterfowl were not affected seriously, except for a short-term decline in mallards. Short- and long-term responses by birds to an oil spill are likely to be species-specific and may be a function of the species' life history and its habitat use and diet (Piatt et al., 1990a; Burger and Fry, 1993; Votier et al., 2005). For a given avian species, if its preferred habitat and food resource are also impacted by a spill, the species will be forced to locate and settle in alternative habitats, modify its foraging behavior, or select alternative food resources. Conversely, fidelity to the impacted area could result in reduced energy uptake through reduced food availability, reduced foraging success, prey switching, or residual sublethal toxicity effects, which may negatively impact body condition and survival (e.g., after the *Exxon Valdez* spill, harlequin ducks [Esler et al., 2000 and 2002] and pigeon guillemots [Seiser et al., 2000; Golet et al., 2002]).

4.1.1 OCS Oil and Gas Activities

Oil spills introduced specifically into coastal waters (as opposed to spills immigrating to coastal waters from offshore) as a result of OCS oil and gas activities are assumed to encroach upon adjacent coastal lands. The Oil Spill Risk Analysis (OSRA) is a model that calculates the movement of hypothetical spills by successively integrating time sequences of two spatially gridded input fields: the surface ocean currents and the sea level winds. Thus, the OSRA model generates time sequences of hypothetical oil spill impact locations–essentially, oil-spill trajectories to assist in estimating impacts to resources. It does not consider the unlikely and unanticipated scenario of an OCS oil spill occurring in close proximity to eastern black rail preferred habitat at the same time as an extremely high tide, wetland loss, a hurricane and sea level rise. OSRA modeling for all three planning areas (CPA, WPA, and EPA) has been completed and is provided below. For more details on OSRA, see Appendix G.

Representative species of the seven bird groups are widely distributed across the Gulf; therefore, an oil spill, depending on its size and distribution, would likely affect only a small fraction of a given species' population. The combined probabilities varied greatly depending on duration (10 days compared to 30 days) and the avian species group considered in the WPA and CPA. The combined probabilities (which represent the estimated probability that 1 or more hypothetical spills ≥1,000 bbl will both occur and contact a resource) associated with avian habitats varied little, irrespective of spill duration (10 days versus 30 days) and the avian species group or threatened or endangered species considered in the EPA.

Depending on the size of the spill, location, time of year, duration, and magnitude of associated oil-spill cleanup efforts, associated activities may impact or further exacerbate coastal bird issues regardless of personnel training and experience (National Audubon Society, Inc., 2010). Should such a spill occur, the OSRA model projected a spill risk within 10 and 30 days for the WPA, CPA and EPA (Figures 1-5). The counties where this species occurs is in Table 1.

Table 1. Coastal counties or parishes of the Gulf of Mexico with eastern black rail occurrence (USFWS, 2018)

Florida		Louisiana	Texas	
Broward	Lee Levy Manatee	Cameron	Aransas	Jefferson
Charlotte	Miami-Dade Monroe		Brazoria	Jackson
Collier Citris Dixie	Pasco Pineallas		Calhoun	Kleberg

Florida		Louisiana	Texas	
Escambia Franklin	Santa Rosa		Chambers	Matagorda
Gulf Hernando	Sarasota Taylor		Galveston	Nueces
Jefferson	Wakulla			

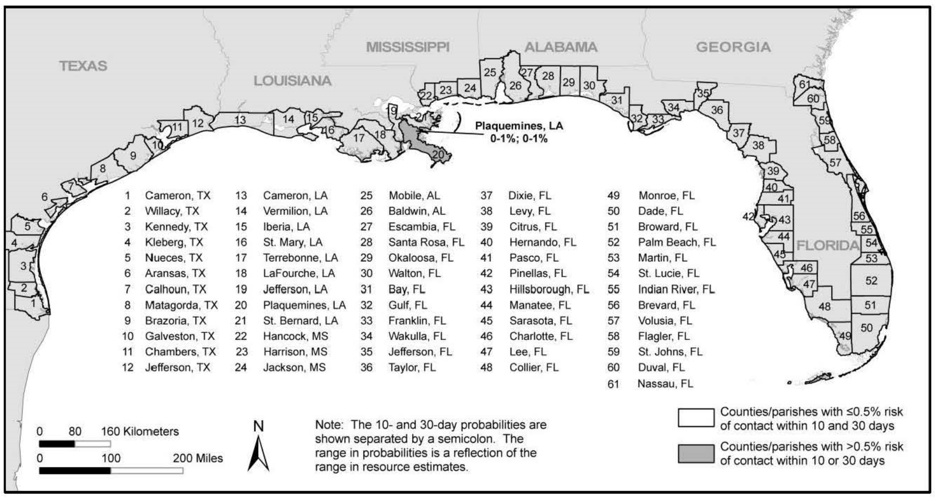

Figure 1. OSRA probabilities of an accidental oil spill (≥1,000 bbl) occurring and contacting within 10 and 30 days the shoreline (counties and parishes) as a result of EPA OCS oil and gas activities.

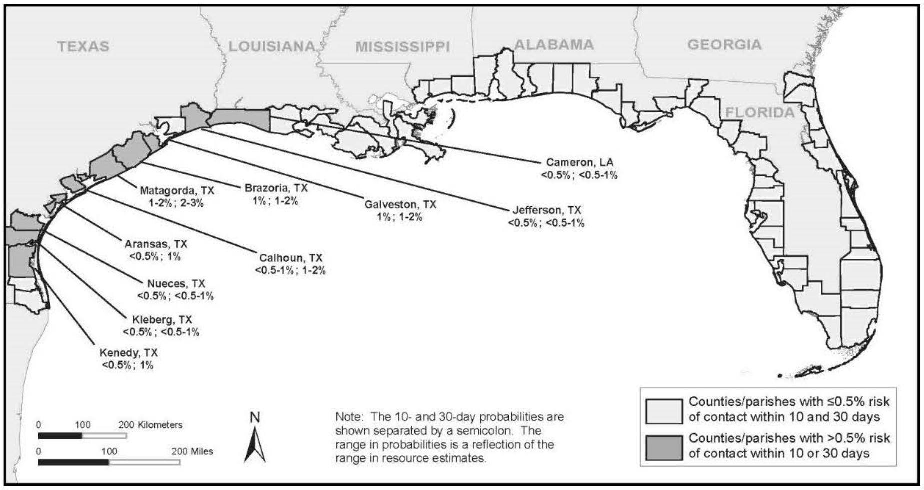

Figure 2. OSRA probabilities of an accidental oil spill (≥1,000 bbl) occurring and contacting within 10 and 30 days the shoreline (counties and parishes) as a result of a WPA OCS oil and gas activities (only counties and parishes with a >0.5% risk of contact within 10 or 30 days are labeled).

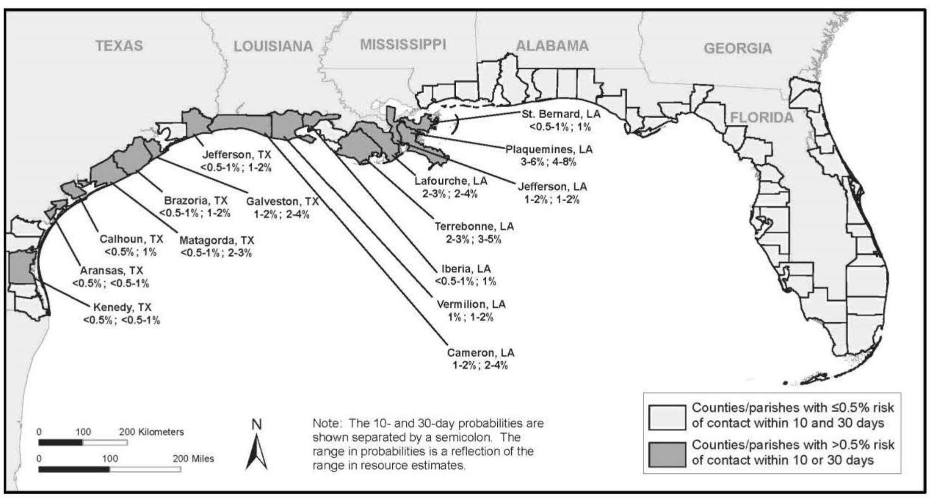

Figure 3. OSRA probabilities of an accidental oil spill (≥1,000 bbl) occurring and contacting within 10 and 30 days the shoreline (counties and parishes) as a result of a CPA OCS oil and gas activities (only counties and parishes with a >0.5% risk of contact within 10 or 30 days are labeled).

In general terms, coastal waters of the planning areas are expected to be impacted by many, frequent, small spills (<1 bbl); few, infrequent, moderately-sized spills (>1 bbl and <1,000 bbl); and a single, large (≥1,000 bbl; risk of <1–2) spill. The assessment of spill frequency (i.e., frequent, infrequent, unlikely) is based relative to the 40-year life span of a lease. Pipelines pose the greatest risk of a large spill occurring in coastal waters. Estimates from spill data show that Federal offshore waters will be subjected to many frequent small spills (≤1 bbl); few, infrequent, moderately-sized spills (>1 bbl and <1,000 bbl); and rare large spills (≥1,000 bbl) as a result of OCS oil and gas activities.

Oil spills introduced specifically into coastal waters (as opposed to spills immigrating to coastal waters from offshore) as a result of OCS oil and gas activities are assumed to encroach upon adjacent coastal lands (For more details on OSRA, see Appendix G). The OSRA modeling results (10- and 30-day probabilities) indicate that a large spill (>1,000 bbl) in Federal offshore waters, should one occur, would have a 3–5 percent and 9–16 percent probability (from CPA) and 5–8 percent and 8–14 percent (from WPA) of impacting Texas State offshore waters. State offshore waters in Louisiana are divided into east and west Louisiana. West Louisiana has a 10–18 percent and 14–25 percent probability (from CPA) and <0.5 percent and a 1 percent (from WPA) while east Louisiana has a 2–4 percent and 3–5 percent probability (from CPA) and <0.5 percent and <0.5 percent (from WPA).

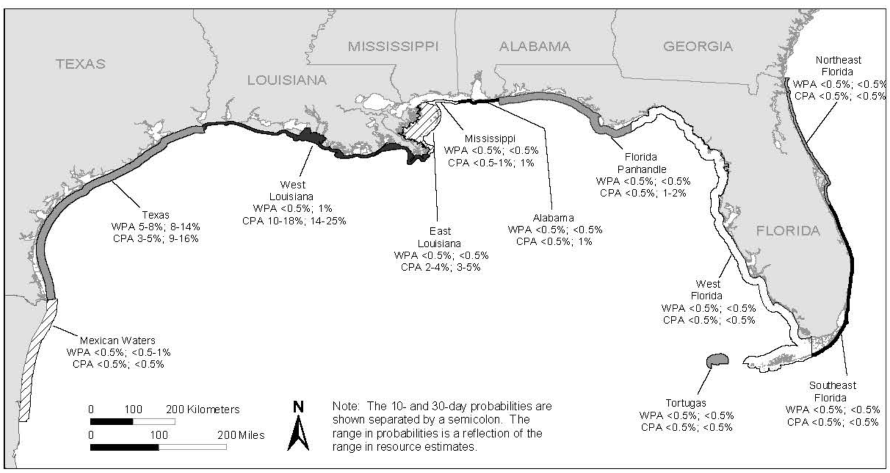

Figure 4. OSRA probabilities of oil spills (≥1,000 bbl) occurring and contacting within 10 and 30 days state offshore waters as a result of a WPA or CPA OCS oil and gas activities.

The OSRA modeling results (10- and 30-day probabilities) indicate that a large spill (>1,000 bbl), if it were to occur in Federal offshore waters (EPA), would have a <0.5 percent probability of impacting Texas State offshore waters. State offshore waters in Louisiana are divided into east and west Louisiana. West Louisiana has a <0.5–1.0 percent probability while east Louisiana has a <0.5–1.0 percent probability of impacts if such a spill were to occur. The OSRA model projected a spill impact risk of <0.5 percent for state offshore waters eastward of Louisiana as a result of activities in the EPA.

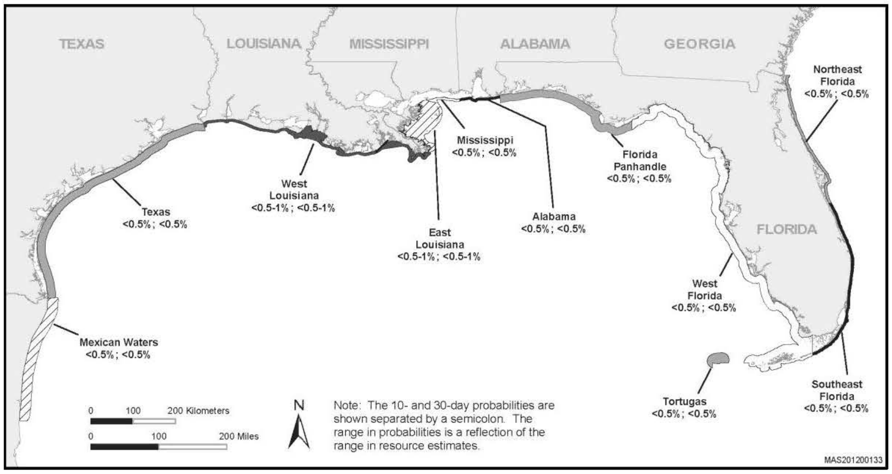

Figure 5. OSRA Probabilities of oil spills (≥1,000 bbl) occurring and contacting within 10 and 30 days state offshore waters as a result of an EPA OCS oil and gas activities.

5. Cumulative Effects

This cumulative analysis considers impact-producing factors (refer also to CEQ, 1997; Pierce, 2011) that may adversely affect populations of threatened and endangered avian species, as well as nonthreatened and nonendangered species related to OCS and non-OCS activities.

5.1 OCS-Related and Non-OCS-Related Air Pollutants

Air pollutants include the amount of sulfur dioxide (and other regulated pollutants) expected to be released due to OCS oil and gas activities, as well as State oil and gas activities. These pollutants may adversely affect coastal and marine birds and their habitats (**Chapter 4.1.1.14.2**). Pollutant emissions into the atmosphere from the activities under the cumulative analysis are expected to have minimal effects on offshore air quality because of the prevailing atmospheric conditions, emission heights, and pollutant concentrations, as regulated by USEPA (but see Wilson et al., 2010, Tables 8-1 and 8-2).

Emissions of pollutants into the atmosphere under the cumulative analysis are projected to have minimal effects on onshore air quality because of the atmospheric regime, emission rates, and the distance of these emissions from the coastline. Onshore impacts to air quality from emissions under the OCS cumulative analysis are expected to be within both Class I and Class II PSD allowable increments, as applied to the respective subareas. Increases in onshore annual average concentrations of NOx, SOx, and PM10 under the cumulative analysis are estimated to be less than Class I and Class II PSD allowable increments for the respective subareas as per both the steady-state and plume dispersion analyses, and they are assumed to be below concentrations that could harm coastal and marine birds (but see **Chapter 4.1.1.14.2**; see also Newman, 1979; Newman and Schreiber, 1988).

Although direct impacts (i.e., mortality) on coastal and marine birds due to air quality under the cumulative analysis are expected to be minimal, indirect impacts may include chronic, sublethal effects including reduced egg viability and hatchability, smaller overall clutch sizes, reduced fledging body mass, and overall fledging success, leading to overall reduced recruitment (refer to Eeva et al., 1997, 2003, and 2005). These effects could be the result of impacts to a bird's habitat or food supply rather than directly on individual birds, per se. If habitat and food resources are negatively impacted by air pollutants during the pre-laying period, it could influence energy devoted to the clutch. At the same time, these same effects could manifest themselves by reduced provisioning rates by adults to nestlings and/or fledglings or by provisioning at similar rates, but with different food resources (i.e., prey switching, whereby the alternative prey has less per capita energy).

Although the incremental contributions of offshore emissions are below or within those allowed by law, it is uncertain to what extent the contributions from OCS-related activities to the overall production of air pollutants on an annual or cumulative basis (refer to Wilson et al., 2010, Tables 8-1 and 8-2) could adversely impact avian populations in the Gulf of Mexico region. Nevertheless, these impacts would not be expected to rise to population-level impacts across the Gulf.

5.2 Water Quality Degradation

Water quality (**Chapters 4.2.1.2.1.1-4.2.1.2.2.4**) of coastal environments will be affected by bilge water from service vessels and point- and nonpoint source discharges from supporting infrastructure associated with OCS oil and gas development (refer to Veil et al., 2004, Table 2-1, for a complete list of substances and amounts from Gulf of Mexico wells). Water quality in marine waters will be impacted by the discharges from drilling, production, and platform removal operations (Veil et al., 2004; Welch and Rychel, 2004; Fraser et al., 2006). Degradation of coastal and inshore water quality resulting from factors related to OCS oil and gas activities; crude oil imports by tankers; and other commercial, military, and recreational offshore and coastal activities is expected to impact coastal and marine birds (**Chapter 4.1.1.16.2**; see also Fraser et al., 2006).

In 2008, USEPA (2008) rated the overall condition of the waters in the Gulf of Mexico at 2.2 (on a scale from 1 to 5, with 5 being highest), one of the lowest scores of any region in the U.S. NOAA (USDOC, NOAA, 2011a, Figure 54) noted that almost half of the 37 major estuarine systems in the Gulf of Mexico were considered moderately polluted. Further, 14 percent of all Superfund sites nationwide that have been cleaned up or remediated occur in the Gulf Coast region (USDOC, NOAA, 2011a, p. 40); 99 of 189 (52%) counties and parishes in Texas, Louisiana, Alabama, Mississippi, and Florida are coastal. Not included during USEPA's monitoring program (USEPA, 2008) were waters in the hypoxic zone (O_2 depleted water) found on the Gulf of Mexico continental shelf adjacent to the outflows of the both the Mississippi and Atchafalaya Rivers (Rabalais et al., 2002a). This area is well known and represents the second largest coastal zone of hypoxia in the world (Rabalais et al., 2001 and 2002b). Thus, the waters of the Gulf Coast region are some of the most contaminated in the U.S. The incremental addition related to OCS oil and gas activities would contribute to further degradation of water quality, but this remains a small addition when compared with all other natural and anthropogenic sources.

5.3 Platform and Pipeline Oil Spills and Any Improperly Directed Spill Response Activities

Oil spills have the greatest potential to impact coastal and marine birds. Use of waterbird, marshbird, shorebird, and seabird feeding areas at the sea surface and at the intertidal wetland zone, where spilled oil may accumulate, makes many avian species extremely vulnerable to spilled oil. Exposure to small amounts of oil may result in long-term, sublethal, chronic impacts on birds with the potential to impact food resources through changes in distribution and abundance (i.e., availability of preferred foods) (e.g., Esler et al., 2002). Mortality from oil spills is often related to numerous symptoms of toxicity. Pipelines are roughly 2 times more likely to produce >1,000 bbl spills compared with facilities.

The extensive oil and gas industry operating in the Gulf area may have caused low-level, chronic, petroleum contamination of coastal waters (Holdway, 2002; Jernelöv, 2010). Outside of a catastrophic event, petroleum spills or releases that result from OCS oil and gas activities would be expected to be small, particularly when compared with naturally occurring seeps in the GOM. Nevertheless, lethal effects are expected primarily from uncontained, inshore oil spills and associated, spill-response activities in wetlands, and other biologically sensitive coastal habitats (National Audubon Society, Inc., 2010; USDOI FWS, 2010e).

5.4 Aircraft and Vessel Traffic and Noise from Helicopters and Service Vessels

Helicopter and service-vessel traffic related to OCS activities would likely disturb feeding, resting, and nesting behavior of birds (at least temporarily), and it may also cause temporary or permanent abandonment of nests, nestlings, fledglings, and emigration from or avoidance of disturbed, preferred habitat (Burke et al., 2005). The Federal Aviation Administration (FAA Advisory Circular 91-36C) and corporate helicopter policy states that helicopters must maintain a minimum altitude of 700 ft (213 m) while in transit offshore and 500 ft (152 m) while working between platforms. When flying over land, the specified minimum altitude is 1,000 ft (305 m) over unpopulated areas or across coastlines and 2,000 ft (610 m) ft over populated areas and biologically sensitive areas, such as wildlife refuges and national parks. The net effect of OCS-related flights on coastal and marine birds is expected to result in temporary, often sporadic disturbances, which may result in displacement of localized individuals. During nesting periods, this could ultimately result in some reproductive failure from nest abandonment or depredation of eggs and young in the absence of a disturbed adult.

Service vessels are expected to use selected nearshore and coastal (inland) navigation waterways, and they are further expected to adhere to guidelines established by USCG for reduced vessel speeds within these inland areas. Routine presence and low speeds of service vessels within these waterways may reduce the disturbance effects from service vessels on nearshore and inland populations of coastal and marine birds. However, to date, efficacy of these measures has not been quantified. It is expected that service-vessel traffic may routinely disturb some populations of coastal and marine birds occurring within these areas.

5.5 Habitat Loss, Alteration, and Fragmentation Resulting from Coastal Facility Construction and Development

Habitat loss and fragmentation remain the largest threats to avian diversity and abundance in the U.S. and worldwide (Gaston et al., 2003; Barrow et al., 2005; Lepczyk et al., 2008). Cumulative activities related to OCS oil and gas activities will likely contribute to further loss, alteration, and fragmentation of avian habitat although at a much smaller spatial scale than non-OCS private and commercial construction and development activities (White and Wilds, 1998).

5.6 Pipeline Landfalls

Factors contributing to coastal landloss or modification include construction of pipeline landfalls for OCS oil and gas activities. From 1996 through 2009, there were 12 OCS-related pipeline landfalls in Louisiana and Texas. Adverse impacts of pipeline canals are the most significant OCS-related impacts to wetlands (Ko and Day, 2004a and 2004b; Morton et al., 2006). Initial impacts are locally significant and largely limited to where OCS-related canals pass through wetlands (Johnston et al., 2009). Wetlands are one of the most ecologically diverse and economically important habitats in the Gulf region, providing a host of benefits to the region's fish and wildlife resources (USDOC, NOAA, 2011a).

Dahl (2006) estimated an annual loss rate of 5,540 ac (2.242 ha) for the intertidal estuarine and marine wetland class, mostly in Louisiana, from all impacting factors. He stated that several factors may have contributed to wetland losses between 1998 and 2004, including deficiency in sediment deposition, canals and artificially created waterways, wave-related erosion, land subsidence, and saltwater intrusion.

5.7 Trash and Debris

Coastal and marine birds may experience chronic physiological stress from sublethal exposure to or intake of contaminants or discarded debris associated with OCS-related activities. This may result in disturbances to and displacement of individuals. Chronic sublethal stress is often a challenge to detect in birds, and more importantly, to directly link to a given environmental stressor independent of other environmental factors (Wiens et al., 2001; Parker and Wiens, 2005). Sublethal stresses may weaken individuals (especially serious for migratory species), making them more susceptible to infection, disease, and parasites. Recruitment of birds and a population's recovery from a major mortality event may take many years, depending upon the species and its life-history strategy.

Much of the floating material discarded from vessels and structures offshore presumably drifts ashore, remains within coastal waters, or eventually sinks. These materials may include lost or discarded fishing gear, such as gill nets and monofilament lines, which cause the greatest overall damage to birds (Tasker et al., 2000; Dau et al., 2009; Ryan et al., 2009). Coastal and marine birds are commonly entangled in discarded trash and debris (Robards et al., 1995). Many species will readily ingest small plastic debris, either intentionally or incidental to consuming prey. Interaction with plastic materials may lead to debilitating injuries or death (Pierce et al., 2004).

It is believed that coastal and marine birds are less likely to become entangled in or ingest OCS-related trash and debris as a result of BSEE regulations regarding the disposal of equipment, containers, and other materials into offshore waters by lessees (30 CFR 250.300, NTL 2012-BSEE-G01, and Appendix B, Gulf of Mexico Marine Trash and Debris Awareness and Elimination Survey Protocols found in the Biological Opinion issued by NMFS on March 13, 2020). In addition, MARPOL, Annex V, Public Law 100-220 (101 Statute 1458), prohibits the disposal of any plastics at sea or in coastal waters (effective January 1, 1989). To date, the efficacy of these regulations on reducing seabird mortality has not been quantified. Despite these regulations, unknown quantities of plastics and other materials are discarded and lost in the marine environment, and so remain a threat to individual birds (Azzarello and Van Vleet, 1987).

5.8 Other Activities Not Related to the OCS Energy Program

Non-OCS related impacts may result in billions of bird deaths compared to the incremental effect of the OCS oil and gas activities (http://www.boem.gov/Environmental-Stewardship/Environmental-Assessment/NEPA/BOEM-2012-019_v2.aspx).

The below list includes these non-OCS related impacts and are presented in more detail within the Multisale EIS (see Multisale EIS USDOI, BOEM, 2012b, pages 4–810):

- Habitat loss, alteration, and fragmentation associated with commercial and residential development
- Tanker oil spills and spills related to oil and gas activities in coastal state waters and spill-response activities
- Pollution of coastal waters resulting from municipal, industrial, and agricultural runoff and discharge

- Nonconsumptive recreation
- Maintenance and use of navigation waterways
- Collisions of coastal and marine birds with various anthropogenic structures
- Diseases
- Climate change and related impacts
- Storms and floods
- Coastal development
- Fisheries interactions

6. Summary and Conclusion

The majority of the effects resulting from BOEM and BSEE routine activities on the eastern black rail are expected to be sublethal (e.g., primarily disturbance-related effects). There is a long-standing and well-developed OCS Program (more than 50 years); there are no data to suggest that routine activities from the preexisting OCS Program are impacting coastal and marine bird populations. When compared with other causes of bird mortality, the routine events associated with the OCS Program are unlikely to result in population-level impacts to the eastern black rail.

Overall, impacts to avian species from routine activities are "not likely to adversely affect" these species. The impacts include the following:

- temporary behavioral changes, temporary or permanent changes in habitat use, temporary changes in foraging behavior, temporary changes to preferred foods or prey switching, temporary or permanent emigration, temporary or permanent reductions in nesting, hatching, and fledging success;
- sublethal, chronic effects due to exposure to or intake of OCS-related contaminants via spilled oil, pollutants in the water from service vessels, produced water, or discarded debris;
- minimal habitat impacts (based on actual acres of footprint) are expected (onshore or within State waters) to occur directly from routine activities resulting from the OCS oil and gas activities (but see Johnston et al., 2009); and
- secondary impacts from pipeline and navigation canals to coastal habitats will occur over the long term and may ultimately displace species to other habitats, if available.

Presently, there are no Gulf of Mexico mitigations (or stipulations) in place specific to the protection and conservation of any birds (including migratory birds) (USDOI, FWS and USDOI, MMS, 2009). However, avoidance measures and conditions are routinely placed on permitted activities to protect habitats.

Overall, impacts to coastal and marine birds associated with accidental events (oil spills regardless of size) in the WPA should be less than in the CPA due to the following factors: fewer platforms; lower oil-spill probabilities; and much lower numbers of predicted oil spills, particularly pipeline spills over the life of WPA OCS oil and gas activities. Oil spills (and disturbance impacts associated with clean up) that may be expected as a result of the OCS oil and gas activities could have the greatest impact on coastal and marine birds. Depending on the timing and location of the spill, even small spills can result in major avian mortality events (Piatt et al., 1990a and 1990b; Castège et al., 2007; Wilhelm et al., 2007). Small amounts of oil can affect birds, and mortality from oil spills is often related to numerous symptoms of toxicity (Burger and Gochfeld, 2001; Albers, 2006). Data from actual spills strongly suggest that impacts to a bird species' food supply are typically delayed after initial impacts from direct oiling (e.g., Esler et al., 2002; Velando et al., 2005b; Zabala et al., 2010). Sublethal, long-term effects of oil on birds have previously been documented (Esler et al., 2000; Alonso-Alvarez et al., 2007a), including changes to sexual signaling (Pérez et al., 2010).

Oil-spill impacts on birds from WPA, CPA, or EPA OCS oil and gas activities are expected to be adverse but not significant given the number and relatively small size of spills expected over the 40-year life of OCS oil and gas activities. Impacts of oil-spill cleanup from OCS oil and gas activities are also expected to be adverse but not significant, but they may be negligible depending on the scope and scale of efforts.

Incidental take, as defined at 50 CFR 402.02, refers only to takings that result from an otherwise lawful activity. The Clean Water Act (33 U.S.C. 1251 et seq.), as amended by the Oil Pollution Act of 1990 (33 U.S.C. 2701 et seq.), prohibits discharges of harmful quantities of oil, as defined at 40 CFR 110.3, into waters of the United States. Therefore, even though this biological assessment considers the effects on listed species by oil spills that may result from BOEM and/or BSEE activities, these impacts would result from an unlawful activity (i.e., oil spills) and have no protective coverage under Section 7(o)(2) of the ESA.

Human-induced disturbance effects often tend to get overlooked or underestimated as potential population-limiting factors for birds (Hockin et al., 1992; Newton, 1998, pp. 365-369). The cumulative effect on coastal and marine birds from all sources is expected to result in changes in species composition and distribution, and a discernable (i.e., low thousands) decline in the number of birds that form localized groups or populations. Some of these changes are expected to be permanent and to stem from a net decrease in preferred habitat for all birds, and possibly impacts to and declines in critical habitat for some endangered species. However, the incremental contribution of the OCS oil and gas program to the cumulative impact is considered "not likely to adversely affect" listed bird species, because the effects of the most probable impacts, such as operational discharges and helicopters and service-vessel noise and traffic, are expected to be sublethal; and some displacement of local individuals or flocks may occur, and displaced birds may move to other habitats, if available.

In general, the net effect of habitat loss from oil spills reasonably expected as a result of OCS oil and gas activities, OCS pipeline landfalls, and maintenance and use of navigation waterways, as well as habitat loss and modification resulting from coastal facility construction and development, will probably reduce the overall carrying capacity of the disturbed habitat(s). That is, impacted habitats may result in reductions to both species composition (fewer species) and abundance (lower numbers) as compared with what the area supported historically. These would be the most serious cumulative impacts on birds.

Disease is often lethal and may take millions of birds annually, but it should be considered a "naturally" occurring avian mortality factor unless the pathogen is introduced by humans (see Newton, 1998). Storms and floods represent natural, often major, disturbances to which exposed organisms are generally adapted. An exception would be hurricane-related storm surges, which are exacerbated by coastal wetland loss in Louisiana and throughout the northern Gulf (Costanza et al., 2008; Engle, 2011). Effects from sea-level rise may be particularly severe for many species of breeding marsh birds and shorebirds (e.g., brown pelican, sandwich tern, black skimmer, Forster's tern, laughing gull, gull-billed tern, royal tern, snowy plover, least tern, and Wilson's plover; USDOI FWS, 2010c), and several species of wintering shorebirds that rely on beaches, flats, dunes, sandbars, shorelines, islands, estuaries, and other low-lying, tidally-influenced habitats in the Gulf of Mexico (Galbraith et al., 2002; North American Bird Conservation Initiative, 2010). Even a nominal rise in sea level (USDOC NOAA, 2011a, pp. 36–37) would inundate much of this habitat, making it unsuitable for many, if not most, of these species. Sea level rise will reduce suitable habitat availability for the eastern black rail and overwhelm habitat persistence. Increased flooding and inundation, saltwater intrusion, and other effects from sea level rise may affect the persistence of coastal or wetland plants that are vital habitat for the eastern black rail (Warren and Niering, 1993; Morris et al., 2002). Further, increased high tide flooding will directly impact the eastern black rail through nest destruction and egg loss at their nesting habitats (Sweet et al., 2017b). Sea level rise may also increase the intensity and frequency of such flooding events.

In conclusion, routine activities and accidental events associated with OCS oil and gas development, are "not likely to adversely affect" the eastern black rail in the Gulf of Mexico. The effects of the OCS oil and gas activities, when viewed in light of the effects associated with other past, present, and reasonably foreseeable future activities may result in adverse impacts to the eastern black rail; however, the effects are not likely to jeopardize the continued existence of this species. A summary of effects from activities is provided in Table 2.

Table 2. Summary of Potential Effects from OCS Oil and Gas Activities for Eastern Black Rail

Species	Activity	No Effect	Not Likely to Adversely Affect	Likely to Adversely Affect
Eastern Black Rail	Discharges		X	
	Aircraft Noise and Operation		X	
	Vessel Noise and Operation	X		
	Drilling and Production Noise	X		
	Marine Debris		X	
	Accidental Events (Oil Spills)		X	

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For further detail on this document, please see relevant sections in the originally provided Biological Assessment and associated Appendices.

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BUREAU OF OCEAN ENERGY MANAGEMENT
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In Reply Refer To: GM 673E

Catherine Marzin
Acting Director, Office of Protected Resources
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catherine.marzin@noaa.com

Via Electronic Mail

Dear Ms. Marzin:

The Bureau of Ocean Energy Management (BOEM) and the Bureau of Safety and Environmental Enforcement (BSEE, collectively the Bureaus), are submitting to the National Marine Fisheries Service (NMFS) the following response to the Bryde's whale (possibly renamed in the future to Rice's whale[1]) jeopardy determination and associated reasonable and prudent alternative (RPA) included in NMFS's programmatic biological opinion entitled, *Biological Opinion for Federally Regulated Oil and Gas Program Activities in the Gulf of Mexico*, which was signed on March 13, 2020 (hereinafter, the 2020 BiOp). During ongoing implementation of the 2020 BiOp and during discussions regarding the jeopardy determination and RPA, the Bureaus implemented a condition of approval on all new and modified permit and plan approvals which noted that approval was based on there being no planned transit through the Bryde's whale area and that any future transit through the area would require advance notice and approval by the Bureaus.

After ongoing coordination between the Bureaus and NMFS, and in accordance with 50 CFR 402.15(b), BOEM and BSEE are notifying you that the Bureaus have decided to adopt the RPA for the Bryde's whale which will eliminate the jeopardy determination for that species in the 2020 BiOp. BOEM requests that NMFS, through a reciprocal letter published to NMFS' website or amendment to the 2020 BiOp, acknowledge and accept the Bureaus' adoption of the RPA which eliminates the jeopardy determination for the Bryde's whale, and update the 2020 BiOp incidental take statement and terms and conditions as necessary.

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[1] Rosel, P.E., L.A. Wilcox, T.K. Yamada, and K.D. Mullin. 2021. A new species of baleen whale (*Balaenoptera*) from the Gulf of Mexico, with a review of its geographic distribution. *Marine Mammal Science*.

Again, we appreciate the opportunity to continue to work together on implementation of the 2020 BiOp.

Sincerely,

MICHAEL CELATA

Digitally signed by MICHAEL CELATA
Date: 2021.04.13 08:48:17 -05'00'

Michael A. Celata
Regional Director, BOEM

I agree:

Lars Herbst 4/19/21

Lars Herbst, Regional Director, BSEE

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United States Department of the Interior

FISH AND WILDLIFE SERVICE
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April 26, 2021

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Gulf of Mexico OCS Region
1201 Elmwood Park Boulevard
New Orleans, Louisiana 70123

Mr. Lars Herbst
Regional Director, Gulf of Mexico OCS Region
Bureau of Safety and Environmental Enforcement
1201 Elmwood Park Boulevard
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Dear Mr. Celata and Mr. Herbst:

Please reference Mr. Tré Glenn's February 12, 2021, electronic mail and attached biological evaluation (BE) for the Bureau of Ocean Energy Management's (BOEM) and Bureau of Safety and Environmental Enforcement's (BSEE) proposed oil and gas leasing, exploration, development, production, decommissioning, and all related activities in the Gulf of Mexico Outer Continental Shelf (OCS) within existing leased areas and those areas proposed for future leasing in the Western Planning Area (WPA), the Central Planning Area (CPA), and the Eastern Planning Area (EPA) on the threatened eastern black rail (*Laterallus jamaicensis jamaicensis*). With a mutual agreement to extend the Service's response date, the BOEM and BSEE request our review of and concurrence with their determination that the proposed activities are not likely to adversely affect the eastern black rail. We have reviewed the information provided and offer the following comments in accordance with provisions of the Endangered Species Act of 1973 (87 Stat. 884, as amended; 16 U.S.C. 1531 et seq).

Proposed Action

The proposed action area includes coastal waters of Texas (TX), Louisiana (LA), Mississippi (MS), Alabama (AL), and Florida (FL) where OCS oil and gas activities are expected to occur across the western, central, and eastern planning areas that are maintained by BOEM and BSEE. The WPA is primarily located within coastal waters of Texas, the CPA within coastal waters of Louisiana, Mississippi, and Alabama, and the EPA within coastal waters of Florida. The proposed action would allow for routine OCS oil and gas activities to continue within the WPA, CPA, and EPA. Activities include aircraft and vessel traffic, pipeline landfalls, terminals, platforms, drilling, discharge, and removal operations. These activities facilitate existing or proposed oil and gas leasing, exploration, development, production, and decommissioning within the action area. Potential occurrence of marine debris resulting from OCS oil and gas activities are included for consideration regarding the proposed action.

Methods for carrying out these activities will follow previously established regulations or protocols in order to ensure compliance with safe operations. Vessels utilizing navigation waterways or corridors will adhere to U.S. Coast Guard regulations to limit vessel speeds within inland areas. Aircraft will adhere to altitude restrictions set forth by the Federal Aviation Administration while working offshore between platform sites or when flying over inland areas. Pipeline landfalls and terminals as well as other onshore infrastructure that result in wetland destruction or modification within the action area require mitigation or restoration as outlined by Section 404 of the Clean Water Act. Discharges, such as produced water, are restricted based on maximum allowable amounts permitted by the National Pollutant Discharge Elimination System. Additionally, daily monitoring will be performed by the permittee through a visual sheen test to maintain compliance with the allowable amounts of discharge. Marine debris that may occur from OCS oil and gas activities within the proposed action area have multiple regulations to prevent introduction of waste material. These include the BSEE regulation (NTL 2012-BSEE-G01) to prohibit improper disposal of equipment, the National Marine Fisheries Service's (NMFS) Gulf of Mexico Marine Trash and Debris Awareness and Elimination Survey Protocols, and the International Convention for the Prevention of Pollution from Ships (MARPOL).

Effects Analysis

Eastern Black Rail

Data for the eastern black rail (EBR) is limited and populations are not well defined throughout the species range. Within Louisiana, the EBR currently has nine identified coastal parishes where habitat may be suitable. Cameron and Vermillion Parish have known occurrence for the EBR while Iberia, St. Mary, Terrebonne, Lafourche, Jefferson, Plaquemines, and St. Bernard Parishes have potential for occurrence. Potentially disturbing activities from the proposed OCS oil and gas activities, such as noise disturbance, air pollution, habitat loss or degradation, and environmental contaminants, could impact the EBR or known/potential habitat. Protocols and regulations provided within the BE, such as those mentioned above, should reduce the potential for harmful effects to the EBR or lessen the impact of those effects if OCS oil and gas activities were to interact directly or indirectly with the species. As mentioned within the BE, oil spills that may occur from these activities have the greatest potential to impact coastal birds like the EBR. Oil that makes its way inland to the coastal parishes inhabited by the EBR or into suitable habitats could negatively impact the species by causing displacement, reduced survival, or direct mortality. However, the probability of such an event occurring as a result of OCS oil and gas activities is relatively low. The Oil Spill Risk Analysis (OSRA) model is utilized within the BE to calculate the probability of an accidental oil spill across the coastal counties or parishes of TX, LA, MS, AL, and FL. For the state of Louisiana, the probability of an accidental oil spill ($\geq$1,000 bbl) occurring and contacting the shoreline within 10 to 30 days as a result of EPA and WPA OCS oil and gas activities are between 0.5 – 1 percent. For the CPA, the probability for LA is between 0.5 – 8 percent varying significantly across the parishes. The probability for oil spills occurring and contacting LA offshore waters is similar for the WPA and EPA, but the CPA is much higher, between 2 – 25 percent. For the EBR, a marsh bird primarily utilizing inland habitats, the increased potential for impact to offshore waters should not be a significant risk to the species or its known/potential habitats within Louisiana's coastal parishes.

Eastern black rails are considered year-round residents along the Texas Gulf Coast. They are known to occur and breed from Jefferson County to Cameron County, with Texas having one of the highest known population numbers of eastern black rails throughout the species range. As previously mentioned, oil that makes its way inland to coastal Texas counties inhabited by the EBR or into suitable habitats could negatively impact the species by causing displacement, reduced survival, or direct mortality. However, the probability of such an event occurring as a result of OCS oil and gas activities is relatively low. The OSRA model is utilized within the BE to calculate the probability of an accidental oil spill across the coastal counties or parishes of TX, LA, MS, AL, and FL. For the state of Texas, the probability of an accidental oil spill (≥1,000 bbl) occurring and contacting the shoreline within 10 to 30 days as a result of CPA OCS oil and gas activities are between 0.5 – 4 percent. For the EPA, the probability for TX is less than 0.5 percent. However, for the WPA, the probability for TX is between 0.5 – 3 percent varying significantly across the coastline. Per the BE, the OSRA modeling results (10- and 30-day probabilities) indicate that a large spill (>1,000 bbl) in Federal offshore waters, should one occur, would have a 3 – 5 percent and 9 – 16 percent probability (from CPA), 5 – 8 percent and 8 – 14 percent probability (from WPA), and ≤ 0.5 percent probability (from EPA) of impacting Texas offshore waters. For the EBR, a marsh bird primarily utilizing inland habitats, the increased potential for impact to offshore waters should not be a significant risk to the species or its known/potential habitats within Texas coastal counties.

The eastern black rail occurs year-round in Florida and has potential for occurrence in Alabama and Mississippi. As mentioned previously, oil that makes its way inland to coastal Florida counties inhabited by the EBR or into suitable habitats could negatively impact the species by causing displacement. Oil that goes into potential habitat for the EBR, such as the coastal counties of Alabama and Mississippi, could negatively impact those habitats by causing degradation or habitat loss. However, the probability of such an event occurring as a result of OCS oil and gas activities is relatively low. The OSRA model is utilized within the BE to calculate the probability of an accidental oil spill across the coastal counties or parishes of TX, LA, MS, AL, and FL. For AL, MS, and FL, the probability of an accidental oil spill (≥1,000 bbl) occurring and contacting the shoreline within 10 to 30 days as a result CPA, EPA, and WPA OCS oil and gas activities are ≤ 0.5 percent. Per the BE, the OSRA modeling results (10- and 30-day probabilities) indicate that a large spill (>1,000 bbl) in Federal offshore waters, should one occur, would have between a 0.5 – 2 percent chance of impacting offshore waters of AL, MS, and FL as a result of CPA, EPA, and WPA OCS oil and gas activities. For the EBR, a marsh bird primarily utilizing inland habitats, the increased potential for impact to offshore waters should not be a significant risk to the species or its known/potential habitats within Alabama, Mississippi, and Florida.

The proposed OCS oil and gas activities within the WPA, CPA, and EPA could potentially impact the EBR or its habitat within coastal counties or parishes within TX, LA, MS, AL, and FL. Effects such as displacement in response to noise disturbance or reduced survival from oil spills could occur from the aforementioned project activities. However, taking into consideration the protocols and regulations that will be implemented to reduce environmental impacts and the risk analyses demonstrating a low probability of oil spills that could significantly impact the species, the OCS oil and gas activities are not likely to adversely affect the eastern black rail. Accordingly, the Service concurs with your determination that implementation of the proposed action is not likely to adversely affect the eastern black rail.

We appreciate the cooperation exhibited by your agencies and look forward to future coordination with BOEM/BSEE in the conservation of endangered and threatened species in the Gulf of Mexico and adjacent coastal habitats. If you have any questions regarding this letter, please contact Joe Hodges (337-291-3109) of this office.

Sincerely,

BRIGETTE FIRMIN

Digitally signed by BRIGETTE FIRMIN
Date: 2021.04.26 16:48:28 -05'00'

Brigette D. Firmin
Acting Field Supervisor
Louisiana Ecological Services Office

cc: FWS, Ecological Services, Houston, TX
FWS, Ecological Services, Jackson, MS
FWS, Ecological Service, Daphne, AL
FWS, Ecological Services, Panama City, FL
Tré Glenn, BOEM, New Orleans, LA
Arie Kaller, BOEM, New Orleans, LA
T.J. Brousssard, BSEE, New Orleans, LA
Daniel Leedy, BSEE, New Orleans, LA

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UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
1315 East-West Highway
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April 26, 2021

Arie Kaller, Supervisor
Office of Environment
Bureau of Ocean Energy Management, Gulf of Mexico
1201 Elmwood Park Blvd.
New Orleans, LA 70123

T.J. Broussard, Regional Environmental Officer
Office of Environmental Compliance
Bureau of Safety and Environmental Enforcement, Gulf of Mexico
1201 Elmwood Park Blvd.
New Orleans, LA 70123

Dear Ms. Kaller and Mr. Broussard,

This letter responds to your letter dated November 3, 2020, requesting a change to your proposed action described in the National Marine Fisheries Service (NMFS) March 13, 2020 programmatic biological opinion (2020 BiOp) on oil and gas activities in the Gulf of Mexico, and your email on November 25, 2020 in which you reiterated your determination that the changes described in the letter will not cause any effect to Endangered Species Act (ESA)-listed species or critical habitat that was not already considered in the biological opinion, and that Bureau of Ocean Energy Management (BOEM) and Bureau of Safety and Environmental Enforcement (BSEE) (BOEM/BSEE) concluded that reinitiation of consultation is not required. This letter also responds to your letter dated April 15, 2021, requesting a change to Appendix I of the BiOp.

Your request in the November 3, 2020 letter entails the removal of specific activities from the proposed action's step-down review process, as described in section 3.4 of the 2020 BiOp. Step-down review involves BOEM/BSEE and NMFS conducting a project-specific review of an activity. The need for, and type of, project-specific review varies depending on the level of uncertainty at the programmatic consultation stage regarding aspects or potential effects of specific projects, approvals, or other actions that will be implemented in the future.

While we agree it is not necessary to reinitiate consultation on the 2020 BiOp, we are amending the associated incidental take statement (ITS) to reflect the changes in BOEM/BSEE's step-down procedures, as well as to address NMFS' Office of Protected Resources (OPR), Permits and Conservation Division issuance of final regulations to govern the taking of marine mammals incidental to geophysical survey activities conducted by oil and gas industry operators in the

Gulf of Mexico over the course of five years, pursuant to section 101(a)(5) of the Marine Mammal Protection Act (MMPA). These regulations will henceforth in this letter be called "MMPA rule".

The step-down procedures outlined in the 2020 BiOp identified specific categories of actions or activities anticipated to warrant further review and evaluation by NMFS and BOEM/BSEE. Those procedures address the following:

- How BOEM/BSEE will evaluate whether such actions or activities would be expected to have effects of an extent and nature consistent with those effects already evaluated in the 2020 BiOp;
- Whether there are any potential effects to ESA-listed species from those actions or activities that would be different than those already evaluated in the 2020 BiOp;
- Whether those effects would be consistent with the effects already evaluated in the 2020 BiOp if the activities were modified (e.g., through different mitigation measures); and
- Whether further consultation would be required based on analysis of the actions or activities.

The categories of activities or plans that BOEM/BSEE requested to be removed from the proposed action's step-down review requirements are detailed below and include the following:

- activities that require the use of moon pools;
- activities that entail lines in the water ("slack lines");
- use of geophysical equipment that operates at frequencies above 180 kHz;
- coring activities; and
- conceptual Deepwater Operations Plans.

The requested removal of these categories of activities from the list of categories requiring step-down review in the 2020 BiOp would constitute changes to the proposed action on the part of BOEM/BSEE. As explained below, BOEM/BSEE and NMFS coordinated closely on the development of these changes, based on additional study and information gained during step-down reviews conducted after the 2020 BiOp and ITS were issued, and also coordinated on the development of effective mitigation measures that can be applied programmatically via standardized permit conditions of approval (COA), in order to remove the need for additional step-down review. Accordingly, we do not believe that these changes will change the effects of the action on, or conclusions related to, species or designated critical habitat listed under the ESA, nor do such changes trigger reinitiation of consultation under 50 CFR 402.16. However, the changes make necessary some minor modifications to the ITS and Reasonable and Prudent Measures (RPMs) / terms & conditions (T&Cs) that were issued with the 2020 BiOp, to reflect these changes to step-down review requirements and related changes to mitigation measures. The rationale for our conclusion that the removal of each of these categories of activities from step-down review requirements will not change the anticipated effects of the proposed action on listed species is discussed below.

As described in the November 3, 2020 BOEM/BSEE letter, there are several categories of activities associated with federally regulated oil and gas activities in the Gulf of Mexico that utilize moon pools. Moon pools represent a potential entrapment risk to ESA-listed species. This entrapment risk exists only for "enclosed" moon pools (i.e., well in the hull of a vessel, with or without a door). There have been documented instances of entrapments of ESA-listed species within moon pools, some of which resulted in injuries to sea turtles, and these instances were the basis for the inclusion of moon pool-related activities in the step-down review process.

NMFS reviewed activities using moon pools via the step-down review process since April 2020. Through these reviews, as well as communications with BOEM/BSEE and industry representatives, NMFS and BOEM/BSEE acquired additional information on the types of activities associated with the use of moon pools (e.g., drilling, pipe-laying, use of divers, etc.), the types of equipment and personnel involved in these activities, and how to best minimize associated potential risks to ESA-listed species.

Since April 2020 there have also been four documented instances of sea turtles observed within moon pools on offshore vessels or structures associated with oil and gas activities in the Gulf of Mexico. BSEE remained in constant communication with the operators during these instances, and also relayed information to us during each response. These instances provided NMFS, BOEM and BSEE with information on risks to ESA-listed species and how best to minimize those risks. In addition, we solicited input from subject matter experts within NMFS on potential impacts to ESA-listed species from entrapment in moon pools, as well as best management practices to minimize impacts when ESA-listed species enter moon pools.

We used the information about moon pools to develop a suite of mitigation measures that BOEM/BSEE will now apply programmatically through COAs to reduce potential effects of this activity on ESA-listed species. We are now confident that the newly-developed programmatic approach to BOEM/BSEE-applied mitigation measures for moon pools is appropriate and sufficiently protective to minimize potential effects from project-specific activities that use moon pools without the need for additional step-down review of such approvals.

Henceforth, BOEM/BSEE will programmatically apply these newly-developed mitigation measures as non-discretionary COAs on all permits that are issued for activities that entail the use of moon pools to minimize or avoid harm to protected species. The application of these COAs and subsequent implementation of the measures for relevant activities will minimize or avoid take related to entanglement and entrapment. A copy of these COAs, provided by the Bureaus, is attached to this letter (in addition to the attached COAs, NMFS will be adding to the Terms and Conditions a requirement for BSEE that instances of protected species observed in a moon pool must be reported daily for as long as an animal remains within the moon pool). Therefore, we are modifying the ITS, RPMs and T&Cs to reflect removal of this category of activities from step-down review requirements. As described above, removal of this category of activities from step-down review requirements does not change the effects of the action or the conclusions of the 2020 BiOp.

As noted in the November 3, 2020 BOEM/BSEE letter, there are several types of activities associated with federally regulated oil and gas activities in the Gulf of Mexico that utilize lines in the water column. These lines in the water column have the potential to result in an entanglement risk to ESA-listed species if they are not taut, or if there is “slack” in the lines. There have been a limited number of reported prior instances of entanglements of protected species due to “slack lines" in the water associated with oil and gas related activities (as noted in Section 8.6 of the 2020 BiOp) that resulted in injury or death.

There are measures in the 2020 BiOp that address this risk: in the proposed action for the NMFS PR1, there are required measures related to ocean bottom nodes or similar gear to minimize the risk of entanglement. Also part of the proposed action is a requirement for step-down review of activities that may result in an entanglement risk. This was incorporated into the action and ITS at the time of the 2020 BiOp due to the level of uncertainty that remained regarding the scope of activities under the oil and gas program that had potential to result in an entanglement risk, beyond those that were known to have an associated risk of entanglement (e.g., ocean bottom nodes). The 2020 ITS Terms and Conditions included generalized risk reduction for entanglement or entrainment (T&C #1, C, i). Reporting of any instances of entanglement is also required in the Terms and Conditions (T&C #3 part 2, BSEE, B, vii).

Similar to the process described above related to moon pools, NMFS has reviewed activities that utilize slack lines in the water through the step-down review process since April 2020. Through these reviews as well as discussions with BOEM/BSEE and industry representatives, NMFS and BOEM/BSEE acquired information on the types of activities associated with the use of slack lines (e.g., remotely operated vehicles, use of divers for decommissioning activities, etc.) and best practices to minimize associated risks to ESA-listed species. NMFS and BOEM/BSEE also developed revisions to improve reporting measures for observations of dead and injured protected species. NMFS also solicited input from subject matter experts on best practices to avoid impacts to ESA-listed species from entanglement in slack lines.

As with moon pools, we used the information about slack line related activities to develop a suite of mitigation measures that BOEM/BSEE will now apply programmatically to reduce potential effects of this activity on ESA-listed species. We are now confident that the newly-developed programmatic approach to BOEM/BSEE-applied mitigation measures for slack lines is appropriate and sufficiently protective to minimize potential effects from project-specific activities that use slack lines and are sufficiently protective to minimize potential effects from project-specific activities that use slack lines. Henceforth, BOEM/BSEE will programmatically apply these newly-developed mitigation measures as non-discretionary COAs on all permits that are issued for activities that entail the use of slack lines to minimize or avoid harm to protected species.

The application of these COAs and subsequent implementation of the measures for relevant activities will minimize or avoid take related to entanglement. A copy of these COAs, provided by BOEM/BSEE, is attached to this letter. Therefore, we are modifying the ITS, RPMs and T&Cs to reflect removal of this category of activities from the step-down review requirements. As described above, removal of this category of activities from step-down review requirements does not change the effects of the action or the conclusions of the 2020 BiOp.

As described in your letter, Deepwater Operation Plans (DWOP) are plans that are reviewed by BOEM/BSEE that conceptually describe planned activities. Those activities are then reviewed by BOEM/BSEE through internal review procedures when BOEM/BSEE get to a planning document stage, such as a Development and Production Plan (DPP), Exploration Plan (EP), or

Development Operations Coordination Document (DOCD). That review by BOEM/BSEE then determines whether each proposed activity necessitates step-down review by NMFS.

We agree with you that a requirement to also review DWOPs via step-down review, in addition to step-down review of DPPs, EPs or DOCDs for the same activity, is redundant. In addition, those conceptually proposed activities as described in DWOPs may not be an accurate representation of an actual activity that ultimately is described in a DPP, EP or DOCD (i.e., while the same activity is described in a DWOP and in a subsequent DPP, EP or DOCD, the description of the activity in the DPP, EP or DOCD is more accurate than the description in the DWOP as more information on the activity is known at the DPP, EP or DOCD stage of the process). Based on the above, we agree with your request for removal of the requirement for step-down review of DWOPs. This change removes the requirement for step-down review of DWOPs from the proposed action. NMFS will therefore revise the associated RPMs and T&Cs in the ITS accordingly to reflect this removal.

The use of non-airgun geophysical and geotechnical (G&G) survey equipment that operates above 180 kHz and the activity of coring were both G&G-related activities that were included in the 2020 BiOp. However, frequencies above 180 kHz are outside the functional hearing ranges of the species that were considered in the 2020 BiOp (Popper et al. 2019; Bartol et al. 1999; Dow et al. 2008; Lenhardt 1994; Lenhardt 2002; Moein et al. 2006; Piniak 2012; Ridgway et al. 1969; Southall et al. 2007). Grab and piston coring activities, such as bottom sampling detailed in the 2020 BiOp, are expected to occur at minimal levels and do not cause noise in the underwater environment. Pursuant to 2020 BiOp, all G&G activities were required to undergo step-down review. However, based on the best available scientific and commercial information, the 2020 BiOp determined non-airgun geophysical equipment that operates above 180 kHz and coring activities are not expected to have any effects on ESA-listed species. Therefore, we agree with BOEM/BSEE' request that these two categories of activities can be removed from the requirement for step-down review. This change will therefore remove these two activities from the general G&G category that triggers step-down review by NMFS. In other words, all but these two activity categories under G&G will remain part of the step down process.

We conclude that BOEM/BSEE's removal of the above activity categories from the proposed action's step-down review requirements are not expected to change the effects of the proposed action analyzed in the 2020 BiOp. NMFS also concludes that these changes to the proposed action will not change the amount or extent of incidental take associated with the proposed action relative to what was considered in the existing 2020 BiOp. With the new mitigation measures provided in the revised action, NMFS finds that for these categories of activities, the corresponding requirements in the T&Cs in the 2020 BiOp's ITS are no longer required to address uncertainty about the effects of these categories of activities. Accordingly, the analysis and conclusions in the 2020 BiOp will not be changed, and NMFS will amend the ITS and associated RPMs and T&Cs to reflect the changes as described herein for the BOEM/BSEE proposed action.

Your request in the April 15, 2021 letter entails a revision to requirements in Appendix I of the BiOp related to monitoring of explosive severance activities. You noted that the existing flight time requirements could pose logistical and safety issues where flight times surpass fuel tank capacities for safe operations. Specifically, your request is to revise the time requirement for post-detonation aerial surveys, from 45 minutes to 30 minutes of monitoring, due to logistical and safety concerns about 45 minute post-detonation aerial surveys potentially requiring refueling of helicopters used for monitoring. As stated in your letter, while pre-detonation monitoring is intended to minimize potential impacts on ESA-listed species, post-detonation monitoring is intended only to monitor for any impacts of the activity after it has occurred (i.e., injury or mortality of sea turtles). Thus, a revision to the post-detonation monitoring period would in no way change the ability of aerial surveys to minimize impacts to ESA-listed species due to explosive severance activities. We have confirmed with the Protected Species Observer Program that revising the post-detonation monitoring period from 45 to 30 minutes will not impact the ability to effectively monitor for any impacts to ESA-listed species following explosive severance activities. We therefore agree with your request and have implemented the requested change to Appendix I of the BiOp. We also agree with your conclusion that this revision will not result in any changes to the effects of the action on ESA-listed species or designated critical habitat beyond those considered in the BiOp, nor would it change the amount or extent of take of ESA-listed species as a result of the proposed action, and we therefore agree with your conclusion that this revision does not trigger reinitiation of consultation under 50 CFR §402.16.

Attached to this letter are BOEM/BSEE's request letters, COAs that will be applied programmatically to the respective activities through the BOEM/BSEE internal review process, and amended ITS including revised appendices.

Sincerely,

Cathryn E. Tortorici TORTORICI.CATHRYN.ELISA.1365826850
Chief, ESA Interagency Cooperation Division

cc:

Michael Celata
Field Special Assistant – Interior Region 6,
Director, Gulf of Mexico Office; Bureau of Ocean Energy Management
1201 Elmwood Park Blvd (GM333C)
New Orleans, LA 70123

Lars Herbst
Field Special Assistant – Interior Region 4,
Director, Gulf of Mexico OCS Office; Bureau of Safety and Environmental Enforcement
1201 Elmwood Park Blvd (GE432A)
New Orleans, LA 70123

Attachment

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
1315 East-West Highway
Silver Spring, Maryland 20910

May 7, 2021

Michael Celata
Field Special Assistant – Interior Region 6,
Director, Gulf of Mexico Office; Bureau of Ocean Energy Management
1201 Elmwood Park Blvd (GM333C)
New Orleans, LA 70123

Lars Herbst
Field Special Assistant – Interior Region 4,
Director, Gulf of Mexico OCS Office; Bureau of Safety and Environmental Enforcement
1201 Elmwood Park Blvd (GE432A)
New Orleans, LA 70123

RE: National Marine Fisheries Service response to the Bureau of Ocean Energy Management and Bureau of Safety and Environmental Enforcement Adoption of the Reasonable and Prudent Alternative for the Gulf of Mexico Programmatic Biological Opinion

Dear Mr. Celata and Mr. Herbst:

Thank you for your letter dated April 19, 2021 regarding the Bureau of Ocean Energy Management and Bureau of Safety and Environmental Enforcement adoption of the National Marine Fisheries Service's Reasonable and Prudent Alternative (RPA) from the March 13, 2020 programmatic biological opinion (2020 BiOp) on oil and gas activities in the Gulf of Mexico. Per the ESA section 7 regulations (50 C.F.R. § 402.02; 16 U.S.C. § 1536(b)(3)(A); 16 U.S.C. § 1536(b)(4); 50 C.F.R. § 402.14(i); § 402.15) there is no requirement to revise the 2020 BiOp or incidental stake statement based on your adoption of the RPA so we will not be issuing a revised BiOp.

We appreciate our continued work together to implement the 2020 BiOp. If you have any questions, please contact Cathy Tortorici, Chief of the ESA Interagency Cooperation Division at cathy.tortorici@noaa.gov or 301.427.8495.

Sincerely,

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Catherine Marzin
Acting Director, Office of Protected Resources

cc:
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1201 Elmwood Park Blvd.
New Orleans, LA 70123

T.J. Broussard, Regional Environmental Officer
Office of Environmental Compliance
Bureau of Safety and Environmental Enforcement, Gulf of Mexico
1201 Elmwood Park Blvd.
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UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Silver Spring, MD 20910

August 12, 2021

Refer to NMFS No: FPR-2017-9234 (PCTS); OPR-2017-00002 (ECO)

Arie Kaller, Supervisor
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T.J. Broussard, Regional Environmental Officer
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RE: 2020-2021 Gulf of Mexico BiOp Annual Review and Adaptive Management Process

Dear Ms. Kaller and Mr. Broussard:

A requirement of the March 13, 2020 Biological Opinion (BiOp) on the Federally Regulated Oil and Gas Program Activities in the Gulf of Mexico and associated amended incidental take statement is an annual review process involving the National Marine Fisheries Service (NMFS), the Bureau of Ocean Energy Management and the Bureau of Safety and Environmental Enforcement (BOEM/BSEE) every year the BiOp is in effect. Because the first annual review is now due, NMFS Office of Protected Resources staff began discussions with BOEM/BSEE staff regarding the annual review and the timeline for its completion. On July 12, 2021,NMFS sent BOEM/BSEE a proposed timeline (see below) based on our discussions. We are writing to request your comments or revisions to the proposed timeline by August 31, 2021, or we will presume concurrence with the proposed timeline.

The annual review process is critical to ensure that annual aggregate activities and associated effects remain within the scope of the opinion. The annual review process is also important to ensure that adjustments to mitigation and/or monitoring requirements can be made, as necessary, via the adaptive management process.

The proposed action in the BiOp stated for timing: "The annual review will cover all projects that occur within a year and will occur during the second quarter of the year for the previous calendar year." We proposed the timeline below to account for this annual review representing the first time an annual summary report will be submitted by BOEM/BSEE under the BiOp and therefore more time may be necessary to meet the annual review requirements. The proposed timeline includes time for BOEM/BSEE to pull together the necessary information, make adjustments to data management systems, or complete other necessary tasks associated with summarizing the program; and for NMFS to conduct reviews of drafts and prepare comments.

Review Parameters:

- Summary report reflects all BOEM/BSEE activities that occurred under the Gulf of Mexico program from March 13, 2020 - March 12, 2021.

Proposed Timeline:

<u>September 2021</u> - Provide draft summary report on program activities (based on draft outline on which NMFS provided comments).

<u>October 2021</u> - First annual review meeting to resolve comments and ensure full program coverage.

<u>November 2021</u> - Revised draft summary report for NMFS review

<u>December 2021</u> - Final summary report

Proposed October 2021 Meeting Goals:

- Ensure that the report comprehensively summarizes BOEM/BSEE activities to implement the BiOp
- Identify implemented actions that are working, those that may not be working and how to resolve those points of concern.

As noted above, because this is the first year that we are conducting the annual review, we are attempting to accommodate the need for more time to complete the annual summary report. While we understand that more time may be required during this first annual review process, we want to ensure that a timeline for completion of the annual review process is agreed upon by BOEM/BSEE and NMFS. We look forward to working with you on the annual review process.

If you have any questions, please contact Allison Hernandez at 301-427-8413, or by email allison.hernandez@noaa.gov or Jordan Carduner at 301-427-8483, or by email jordan.carduner@noaa.gov, or me at (301) 427-8495, or by email at cathy.tortorici@noaa.gov.

Sincerely,

CARRUBBA.LISAMARIE.1365823932 Digitally signed by CARRUBBA.LISAMARIE.1365823932 Date: 2021.08.12 16:09:20 -04'00'

Dr. Lisamarie Carrubba
for Cathryn E. Tortorici,
Chief, ESA Interagency Cooperation Division
Office of Protected Resources

UNITED STATES DEPARTMENT OF COMMERCE
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NATIONAL MARINE FISHERIES SERVICE
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263 13th Avenue South
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July 29, 2022 F/SER4:DD

Mr. Michael A. Celata, Regional Director
Bureau of Ocean Energy Management (BOEM)
Gulf of Mexico OCS Region (GM 670)
1201 Elmwood Park Boulevard
New Orleans, Louisiana 70123-2394

Dear Mr. Celata:

NOAA's National Marine Fisheries Service (NMFS) has reviewed the Essential Fish Habitat (EFH) Assessment for Oil and Gas Activities in the Gulf of Mexico (BOEM 2022-032) dated May 2022.

Background

Section 305(b) of the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act) requires federal agencies to consult with the Secretary of Commerce, through NOAA's National Marine Fisheries Service (NMFS), with respect to "any action authorized, funded, or undertaken, or proposed to be authorized, funded, or undertaken, by such agency that may adversely affect any EFH identified under this Act." NMFS published the final rule implementing the EFH provisions of the Magnuson-Stevens Act on January 17, 2002. BOEM oversees the National Outer Continental Shelf Oil and Gas Leasing Program pursuant to Section 18 of the Outer Continental Shelf Lands Act (OCSLA). Certain activities authorized by BOEM may result in adverse effects to EFH and require consultation.

In 1999, our agencies consulted on a programmatic level to address EFH issues related to operational activities, including pipeline rights-of-way, plans for exploration and production, and platform removal in the Gulf of Mexico Central and Western Planning Areas. That programmatic EFH consultation was subsequently amended in 2007 to also include operational activities within a small portion of the Eastern Planning Area. Following the Mississippi Canyon Block 252 spill event in April 2010, BOEM requested re-initiation of Endangered Species Act consultation with both the U.S. Fish and Wildlife Service and NMFS. NMFS responded by letter dated September 24, 2010, requesting a review of the EFH consultation as well. At that time, regional NMFS and BOEM staff agreed to procedures which would incorporate a programmatic EFH consultation within the National Environmental Policy Act (NEPA) document prepared for the 2012-2017 five-year multi-lease sale program. Another EFH Assessments was prepared for the 2017-2022 program.

Proposed Actions

The proposed actions addressed in the BOEM EFH Assessment include reasonably foreseeable oil and gas activities on the Gulf of Mexico's Outer Continental Shelf (OCS), including proposed lease sales and activities related to exploration, development, production, and decommissioning, including, but not limited to, geological and geophysical (G&G) activities, drilling, construction, support, removal, and site clearance operations. Related activities not occurring on the OCS, such as inshore and onshore activities (e.g., vessel traffic, navigation channel maintenance, and new pipeline landfalls) are also addressed and assessed for potential impacts to EFH and federally managed fisheries species (i.e., species managed under a fisheries management plan (FMP)) in the Gulf of Mexico.

EFH Assessment

Section 2.0 of the BOEM EFH Assessment details measures implemented through operating regulations, lease stipulations, Notices to Lessees and Operators (NTLs), and project-specific requirements or conditions of approval to minimize potential impacts on EFH that could result from BOEM-regulated activities on the OCS. Such measures also address concerns related to endangered and threatened species, geologic and human made hazards, military warning and ordnance disposal areas, archaeological sites, air and water quality, sensitive benthic communities, artificial reefs, operations in hydrogen sulfide prone areas, and shunting of drill effluents in the vicinity of biologically sensitive features. Additionally, BOEM reviews proposed activities for compliance with regulatory requirements and applies conditions of approval as needed. Section 5.0 describes how mitigation measures are applied in specific categories of EFH. Section 8.0 provides the views of BOEM on the effects of regulated activities and proposed mitigation measures to avoid and minimize the potential for adverse effects to EFH and managed species.

To ensure adverse impacts to EFH and federally managed fisheries from activities managed by BOEM Gulf of Mexico Region are avoided, minimized, and offset, the implementation of EFH conservation measures is necessary.

EFH Conservation Recommendations

1. The NMFS incorporates by reference and adopts the mitigation measures described in Section 2.0 and 5.0 as EFH conservation recommendations. Those measures are based on prior programmatic EFH consultations between BOEM and NMFS and specifically include the following NTLs:

    a. NTL 2009-G39; Biologically-Sensitive Underwater Features and Areas including the Topographic Features and Live-Bottom (Pinnacle Trend) Stipulations. This NTL protects and minimizes impacts to sensitive topographic features, pinnacle trend features, and low relief, potentially sensitive features through avoidance and exclusion zones.

        i. The Topographic Features Stipulation minimizes potential impacts on topographic features from bottom-disturbing activities (structure removal and emplacement) and operational discharges associated with the proposed action through avoidance, by requiring individual activities to be located at specified distances from the feature or zone.

ii. The Live-Bottom (Pinnacle Trend) Stipulation minimizes the potential impacts from oil and gas operations, including accidental oil spills and blowouts, on the biota of Pinnacle Trend features by increasing the distance of such events from the features.

b. NTL 2009-G40 Deepwater Benthic Communities. This NTL greatly reduces the risk of physical impacts by requiring the avoidance of potential chemosynthetic communities. It includes requirements to avoid potential chemosynthetic communities identified on required geophysical survey records or photo-documentation to establish the absence of potential hard-bottom communities prior to approval of the structure emplacement. BOEM Gulf of Mexico Region shall initiate project-specific EFH consultation with NMFS whenever a shorter separation distance is proposed for seafloor disturbing activities and BOEM determines this may result in adverse effects to EFH.

2. NTL 2015-G03 Marine Trash and Debris Awareness and Elimination is adopted as an EFH conservation recommendation. This NTL describes Bureau of Safety and Environmental Enforcement's (BSEE) requirements for prevention of marine debris from oil- and gas-related activities and outlines annual training and reporting requirements.

3. NTL 2009-G04 Significant OCS Sediment Resources of the Gulf of Mexico is adopted as an EFH conservation recommendation. This NTL identifies BOEM's responsibility as stewards of significant sand resources on the OCS and provides guidance for the avoidance and protection of significant OCS sediment resources essential to coastal restoration initiatives in the Gulf of Mexico. Additionally, this NTL discourages abandoning pipelines in areas with significant sediment resources. OCS sediment resources are necessary for coastal resiliency and restoration projects and programs, which can protect and restore EFH.

4. NTL 2009-G34 Ancillary Activities is adopted as an EFH conservation recommendation. This NTL provides guidance on conducting ancillary activities that disturb the seafloor in the Gulf of Mexico OCS.

5. NTL 2008-G05 Shallow Hazards Program is adopted as an EFH conservation recommendation. This NTL describes surveys, reports, analyses, and mitigation to ensure exploration, development, production, and transportation operations are conducted with a minimum risk to human life and the environment.

6. NTL 2019-G05 Site Clearance and Verification for Decommissioned Wells, Platforms, and Other Facilities is adopted as an EFH conservation recommendation. This NTL ensures that any object (i.e., wellheads, platforms, etc.) installed on an OCS lease is properly removed and the site cleared so as not to conflict with other uses of the OCS.

7. NTL 2009-G27 Submitting Exploration Plans and Development Operations Coordination Documents is adopted as an EFH conservation recommendation. This NTL provides policy

for revising OCS plans when operators propose to change approved anchor patterns or anchor areas.

8. NTL 2012-N06 Guidance to Owners and Operators of Offshore Facilities Seaward of the Coast Line Concerning Regional Oil Spill Response Plans is adopted as an EFH conservation recommendation. This NTL provides guidance concerning the preparation of regional Oil Spill Response Plans.

9. BOEM continue to provide NMFS with yearly summaries describing:
   a. The number and type of permits issued in each planning area each year and describing the number and type of activities located in the Live-Bottom (Pinnacle Trend) and Topographic Features blocks for that year.
   b. The decommissioning activities completed in Live-Bottom (Pinnacle Trend) and Topographic Features blocks for that year.
   c. The number of seismic surveys proposing to utilize ocean-bottom surveys that year.
   d. The number of and/or miles of decommissioned pipelines including the number of waivers, if any, granted for the burial requirement, thereby allowing self-burial that year.

Please be advised the Magnuson-Stevens Act and the regulations to implement the EFH provisions (50 CFR Section 600.920) require your office to provide a written response to this letter. That response must be provided within 30 days and at least 10 days prior to final agency action. A preliminary response is acceptable if final action cannot be completed within 30 days. Your final response must include a description of measures to be required to avoid, mitigate, or offset the adverse impacts of the activity. If your response is inconsistent with our EFH conservation recommendation(s), you must provide an explanation of the reasons for not implementing those recommendation(s).

Review and Revision

BOEM requests this EFH consultation not be tied to a specific five-year OCS Leasing Program but rather to focus on the suite of BOEM and BSEE authorized activities associated with any National OCS Leasing Program. If any modifications are made to BOEM or BSEE programs, site and activity specific review procedures, lease stipulations, and NTLs described in the EFH Assessment that result in changes to potential adverse effects on EFH, the BOEM Gulf of Mexico Region should notify the NMFS Southeast Region Habitat Conservation Division to initiate discussions regarding the necessity to modify this EFH consultation.

Reinitiation will occur as necessary, such as when NMFS and BOEM jointly agree to reinitiate consultation, when BOEM significantly alters the proposed action, or upon meeting conditions for site-specific EFH consultation. In addition, BOEM subject-matter experts routinely review activities for proposed technologies, methods, locations, and other sources of potential effects to species and habitats. This process includes concurrent reviews for circumstances that could result in the initiation of site-specific EFH consultation as determined by the above EFH conservation recommendations. BOEM will continue to evaluate and assess risks to federally managed species and EFH in upcoming environmental compliance documentation under NEPA and other statutes based on the most recent and best available information. Additionally, BOEM currently has an environmental study underway in the northern Gulf of Mexico investigating pipeline displacement for both active and abandoned pipeline segments. If new or additional information affecting EFH conservation recommendations becomes available, NMFS will consider whether to request additional consultation with BOEM and/or provide additional EFH conservation recommendations.

Finally, NMFS advises BOEM that at this time the Gulf of Mexico Fishery Management Council in the early phases of amending EFH information in their FMPs and the NMFS Highly Migratory Species Management Branch released Amendment 10 to the 2006 Consolidated Atlantic Highly Migratory Species FMP in 2017 updating EFH information from the 2009 Final Amendment 1 referenced in the BOEM EFH Assessment.

Thank you for your consideration of these recommendations. If we can be of further assistance, please do not hesitate to contact David Dale at 727-824-5317 or by email at david.dale@noaa.gov.

Sincerely,

FAY.VIRGINIA.M.1365817320 Digitally signed by FAY.VIRGINIA.M.1365817320 Date: 2022.07.29 11:56:08 -04'00'

Virginia M. Fay
Assistant Regional Administrator
Habitat Conservation Division

cc: via electronic mail
F/SER4 – Swafford
GMFMC – Simmons
NOS/FGNMS – Schmall
BOEM – Kaller, Belter

United States Department of the Interior
BUREAU OF OCEAN ENERGY MANAGEMENT
New Orleans Office
1201 Elmwood Park Blvd
New Orleans, Louisiana 70123-2394

Ms. Virginia Fay
Assistant Regional Administrator
Habitat Conservation Division
National Marine Fisheries Service
Southeast Regional Office
263 13th Avenue, South
Saint Petersburg, Florida 33701

Via Electronic Mail

Dear Ms. Fay:

This letter is in response to the conservation recommendations (CRs) received from the National Marine Fisheries Service's (NMFS) Southeast Regional Office (SERO) for reasonably foreseeable oil and gas activities on the Gulf of Mexico (GOM) Outer Continental Shelf (OCS). Reasonably foreseeable activities include proposed lease sales and activities related to exploration, development, production, and decommissioning, including, but not limited to, geological and geophysical activities, drilling, construction, support, removal, and site clearance operations. In the enclosed letter, NMFS/SERO proposes to adopt several of the Bureau of Ocean Energy and Management's (BOEM) Notices to Lessees and Operators (NTLs), including mitigation measures, as CRs and specifies annual reporting requirements. In addition, NMFS requests that BOEM subject matter experts (SMEs) continue to use the most recent and best available science when assessing risks to federally managed species and EFH in environmental compliance documentation under NEPA and other statues; requests notification if new information from BOEM's ongoing pipeline displacement study becomes available and could inform mitigation revisions to better avoid potential impacts to EFH; and specifies additional circumstances in which modifications or reinitiation of this programmatic EFH consultation could be warranted.

EFH Conservation Recommendations

BOEM concurs with the adoption of the following NTLs and any included mitigation measures as CRs:

- NTL 2009-G39 (Biologically-Sensitive Underwater Features and Areas Including the Topographic Features and Live-Bottom (Pinnacle Trend) Stipulations).
- NTL 2009-G40 (Deepwater Benthic Communities)
- NTL 2015-G03 (Marine Trash and Debris and Elimination)
- NTL 2009-G04 (Significant OCS Sediment Resources of the GOM)
- NTL 2009-G34 (Ancillary Activities)
- NTL 2019-G05 (Site Clearance and Verification for Decommissioned Wells, Platforms, and Other Facilities)

- NTL 2012-N06 (Guidance to Owners and Operators of Offshore Facilities Seaward of the Coast Line Concerning Regional Oil Spill Response Plans)

BOEM concurs to provide the following information as annual reporting requirements:

- Number and type of permits issued in each planning area each year and describing the number and type of activities located in the Live Bottom (Pinnacle Trend) and Topographic Features blocks.
- Decommissioning activities completed in Live Bottom (Pinnacle Trend) and Topographic Features blocks.
- The number of seismic surveys proposing to utilize ocean-bottom surveys.
- The number of and/or miles of decommissioned pipelines, including the number of waivers granted for the burial requirement, thereby allowing self-burial that year.

BOEM does not concur with the adoption of the following NTLs as they have little to no direct impacts on the environmental and mitigation process:

- NTL 2008-G05 (Shallow Hazards Program)
- NTL 2009-G27 (Submitting Exploration Plans and DOCDs)

However, BOEM will inform NMFS/SERO of any revisions to the aforementioned NTLs that could potentially result in adverse impacts to EFH or the environmental review process and application of mitigations.

Review and Revision

NMFS requested that BOEM continue to evaluate and assess risks to federally managed species and EFH in upcoming environmental compliance documentation under NEPA and other statues based on the most recent and best available information. This is a routine part of BOEM's environmental review process and BOEM SMEs in the New Orleans Office (NOO) will continue this practice.

Upon completion of BOEM's pipeline displacement study, BOEM/NOO will provide NMFS/SERO with a summary of the findings. Additionally, the Bureau of Safety and Environmental Enforcement (BSEE) is developing a study to better assess the potential environmental impacts from abandoned pipelines and pipeline infrastructure, which will include coordination between BOEM and BSEE environmental SMEs. Findings will also be shared with NMFS/SERO and incorporated into the bureaus' NEPA and compliance/enforcement programs. The summaries will include any new information on potential adverse effects to EFH and the bureaus' recommendation(s) if it is determined new information resulting from the studies could inform changes to mitigations or CRs.

BOEM requested in their programmatic *EFH Assessment for Oil and Gas Activities in the Gulf of Mexico* (BOEM 2022-032), submitted to NMFS/SERO on May 25th, 2022, that consultation no longer be tied to a specific 5-year National OCS Oil and Gas Leasing Program but rather to focus on the suite of BOEM and BSEE authorized activities associated with any National OCS Oil and Gas Leasing Program. Specifically, BOEM requested programmatic EFH consultation be reinitiated under the following circumstances:

- NMFS and BOEM jointly agree to reinitiate consultation
- BOEM significantly alters the proposed action
- Upon meeting conditions for site-specific EFH consultation

NMFS/SERO requested that they also be notified of changes to the following if the change or revision may affect EFH, BOEM's ability to implement agreed upon measures, or BOEM's ability to mitigate potential impacts:

- BOEM and BSEE Programs (e.g., initiation of carbon sequestration activity);
- BOEM and BSEE site- and activity-specific review procedures;
- Lease stipulations; and
- NTLs or other guidance (e.g., Best Management Practices).

BOEM/NOO will notify NMFS/SERO of any changes to Programs, review processes, lease stipulations, or guidance that could result in changes to potential adverse effects on EFH. Finally, BOEM/NOO proposes to coordinate with NMFS/SERO every 5-years to review the programmatic EFH consultation for needed updates or reinitiation.

Thank you for your continued collaboration on the review of activities associated with oil and gas leasing on the OCS in the GOM. If you have any questions, please feel free to contact Mariana Steen at (504) 736-2642 or mariana.steen@boem.gov.

Sincerely,

AGATHA-MARIE KALLER

Digitally signed by AGATHA-MARIE KALLER
DN: c=US, o=U.S. Government, ou=Department of the Interior, ou=Bureau of Ocean Energy Management, cn=AGATHA-MARIE KALLER, 0.9.2342.19200300.100.1.1=14001001248643
Date: 2022.09.26 15:27:53 -05'00'

Dr. Agatha-Marie Kaller
Regional Supervisor
Office of Environment
BOEM

In concurrence:

TOMMY BROUSSARD

Digitally signed by TOMMY BROUSSARD
Date: 2022.09.27 07:34:45 -05'00'

Mr. TJ Broussard
Regional Environmental Officer
Office of Environmental Compliance
BSEE

Enclosure

cc: Mr. Rusty Swafford
Branch Chief
Habitat Conservation Division
National Marine Fisheries Service
Southeast Regional Office
263 13th Avenue, South
Saint Petersburg, Florida 33701

United States Department of the Interior
BUREAU OF OCEAN ENERGY MANAGEMENT
New Orleans Office
1201 Elmwood Park Blvd
New Orleans, Louisiana 70123-2394

29 September 2023

[Name and address]

Dear [Tribal Leader]:

I am writing to notify you of the Bureau of Ocean Energy Management's (BOEM) intent to prepare a Gulf of Mexico (GOM) Regional Outer Continental Shelf (OCS) Oil and Gas Programmatic Environmental Impact Statement (GOM Oil and Gas Programmatic EIS), and to invite the [Tribe] to engage in government-to-government consultation with BOEM on these activities as the Tribal government deems appropriate.

The GOM Oil and Gas Programmatic EIS will analyze the potential impacts of a representative oil and gas lease sale in available OCS areas of the Western, Central, and Eastern Planning Areas and the associated potential site and activity-specific approvals resulting from a sale. A map of the three Planning areas is enclosed. The purpose of the Federal Proposed Action is to offer for lease, and ultimately to allow for potential post-lease development through plan and permit approvals (subject to additional environmental review and regulatory oversight), those areas that may contain economically recoverable oil and gas. Each individual proposed lease sale would provide qualified bidders the opportunity to bid upon and lease available acreage in the GOM OCS in order to explore, develop, and produce oil and natural gas. This Programmatic EIS is expected to be used to inform the decision for the first GOM lease sale proposed in the 2024-2029 National OCS Oil and Gas Leasing Program. It also is expected to be used and supplemented as appropriate for decisions on future proposed GOM lease sales. In addition, this Programmatic EIS will be used for tiering of associated post-lease site and activity-specific OCS oil- and gas-related activity analyses and approvals. Specifically, the GOM Oil and Gas Programmatic EIS will provide a programmatic environmental analysis and framework to support future decision-making on individual plan and permit submittals.

In this PEIS, BOEM is proposing to analyze four alternatives to the Proposed Action: a no action alternative and three action alternatives. Because this Programmatic EIS analyzes a representative lease sale, Alternative A (No Action) is the cancellation of a single proposed GOM lease sale. A complete description of the alternatives considered may be found here: https://www.boem.gov/Gulf-of-Mexico-Oil-and-Gas-PEIS. The draft Programmatic EIS will include a summary of all alternatives, information, and analyses submitted during the scoping process for consideration by BOEM and the cooperating agencies. After the draft Programmatic EIS is completed, the U.S. Environmental Protection Agency will publish a notice of availability (NOA). BOEM will also request public comments on the draft Programmatic EIS through its own NOA for the draft PEIS. BOEM currently expects both NOAs for the draft Programmatic EIS to be published in summer 2024. After the public comment period ends, BOEM will review and respond to comments received and will develop the final PEIS. BOEM will make the final Programmatic EIS available to the public at least 30 days prior to issuance of any Record of Decision (ROD). If the decision is to hold a sale, a ROD will document the final decision on the area and terms to be offered in the sale, including any required mitigation (e.g., through lease stipulations).

As the first public step in this process, BOEM published a Notice of Intent (NOI) to prepare the GOM Oil and Gas Programmatic EIS in the Federal Register on September 29th, 2023. Information and materials related to the GOM Oil and Gas Programmatic EIS can be found at: https://www.boem.gov/Gulf-of-Mexico-Oil-and-Gas-PEIS. This NOI announces the scoping process BOEM will use to identify significant issues and potential alternatives for consideration in the GOM Oil and Gas PEIS.

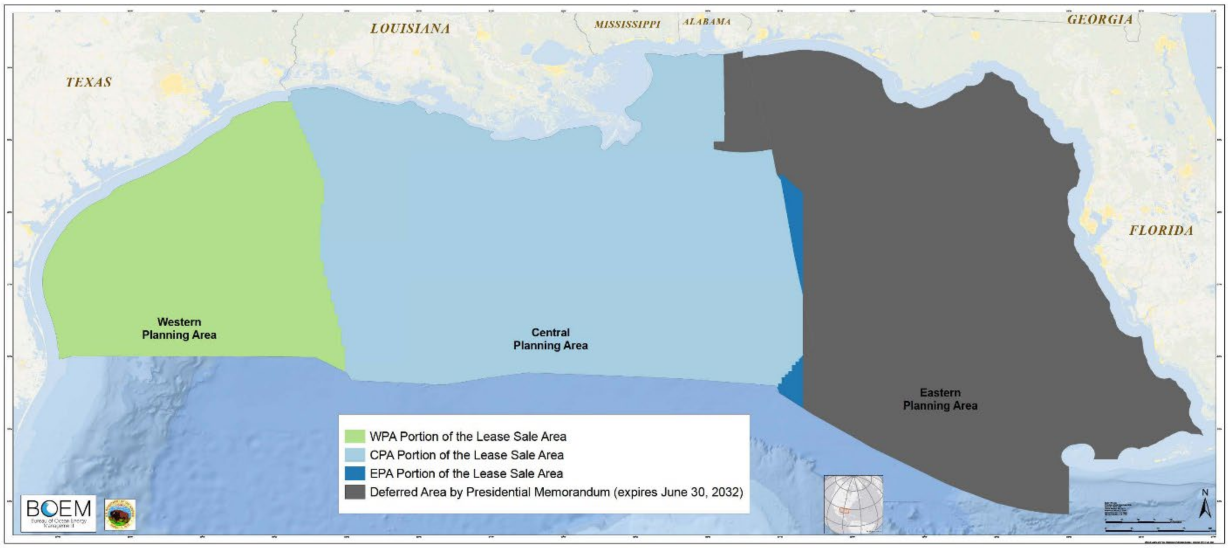
BOEM invites the [Tribe] to engage in dialog through government-to-government consultation on the GOM Oil and Gas Programmatic EIS and its implications for the Tribe. If you would like to schedule a government-to-government meeting or are interested in becoming a cooperating agency on the Programmatic EIS, please contact the acting BOEM Gulf of Mexico Region Tribal Liaison, Mr. Chris Page, at christopher.page@boem.gov or (504) 736-1742. We will send a follow-up letter near the time of publication of the draft Programmatic EIS unless we receive a response requesting otherwise. We look forward to engaging with your tribe on this action.

Sincerely,

James Kendall
Regional Director

Enclosures:
Planning Area Map

cc:


LOUISIANA
MISSISSIPPI
ALABAMA
GEORGIA
TEXAS
FLORIDA
Western
Planning Area
Central
Planning Area
Eastern
Planning Area
WPA Portion of the Lease Sale Area
CPA Portion of the Lease Sale Area
EPA Portion of the Lease Sale Area
Deferred Area by Presidential Memorandum (expires June 30, 2032)
BOEM
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APPENDIX F

PROPOSED LEASE MITIGATING MEASURES

F PROPOSED LEASE MITIGATING MEASURES

F.1 STIPULATIONS

F.1.1 Introduction

Mitigations can be applied at the lease sale stage, typically through applying what are commonly referred to as lease stipulations to Outer Continental Shelf (OCS) oil and gas leases as a result of any given lease sale. Stipulations are attached to OCS oil and gas leases and are legally binding. Stipulations are applied to leases when a lessee obtains a lease, while conditions of approval are applied to permits during the post-lease review process.

This appendix discusses the potential lease stipulations that could be considered for a lease sale. These potential lease stipulations were developed from numerous scoping efforts from previous lease sales. The Topographic Features and Live Bottom (Pinnacle Trend) Stipulations have been applied as programmatic mitigation in the 2024-2029 National OCS Oil and Gas Program Programmatic EIS (BOEM 2023a) and Record of Decision (BOEM 2023b) and, therefore, would apply to all leases issued for Gulf of Mexico (GOM) lease sales under the 2024-2029 National OCS Oil and Gas Program in designated lease blocks. The other nine lease stipulations described below could be considered for future GOM lease sales, as applicable. The analysis of any stipulations for any particular alternative does not ensure that the Assistant Secretary for Land and Minerals Management will decide to apply the stipulations to OCS oil and gas leases that may result from any OCS oil and gas lease sale nor does it preclude minor modifications in wording during subsequent steps in the prelease process if comments indicate changes are necessary or if conditions change.

Lease stipulations are considered for adoption by the Assistant Secretary for Land and Minerals Management, under authority delegated by the Secretary of the Interior, and any stipulations to be included in a lease sale are described in the Record of Decision for that lease sale. Mitigating measures in the form of lease stipulations are added to the lease terms and are therefore enforceable as part of the lease. In addition, each exploration and development plan, as well as any pipeline applications that result from a lease sale, will undergo a National Environmental Policy Act review, and additional project-specific mitigations may be applied as conditions of plan approval at the post-lease stage. The Bureau of Safety and Environmental Enforcement (BSEE) has the authority to monitor and enforce these conditions and, under 30 CFR part 250 subpart N, may seek remedies and penalties from any operator that fails to comply with those conditions, stipulations, and mitigating measures.

Some lease stipulations apply to all blocks that may be offered, while other lease stipulations apply only to specified blocks. Each Final Notice of Sale package will include maps indicating which blocks will have potential lease stipulations, and the “List of Blocks Available for Leasing” contained in the Final Notice of Sale package will identify the lease stipulations applicable to each block. The Final Notice of Sale package will contain the Final Notice of Sale, information to lessees, and lease stipulations. In addition, the Final Notice of Sale package will show any additional areas not available for lease, including areas that have been removed from leasing in the Record of Decision. A list of potential lease stipulations for Gulf of Mexico OCS oil and gas lease sales includes the following:

- Stipulation No. 1 – Military Areas;
- Stipulation No. 2 – Evacuation;
- Stipulation No. 3 – Coordination;
- Stipulation No. 4 – Protected Species;
- Stipulation No. 5 –Topographic Features;
- Stipulation No. 6 – United Nations Convention on the Law of the Sea Royalty Payment;
- Stipulation No. 7 – Agreement between the United States of America and the United Mexican States Concerning Transboundary Hydrocarbon Reservoirs in the Gulf of Mexico;
- Stipulation No. 8 – Live Bottom;
- Stipulation No. 9 – Blocks South of Baldwin County, Alabama;
- Stipulation No. 10 – Restrictions due to Rights-of-Use and Easements for Floating Production Facilities; and
- Stipulation No. 11 – Royalties on All Produced Gas.

F.2 STIPULATION NO. 1 – MILITARY AREAS

F.2.1 Stipulation Overview

Stipulation No. 1 may be included in leases, issued as a result of an OCS oil and gas lease sale, located within the Warning Areas and Eglin Water Test Areas as shown in **Figure F.2-1**. The Military Areas Stipulation has been applied to all blocks leased in military areas since 1977 and reduces potential impacts, particularly in regard to safety, but it does not reduce or eliminate the actual physical presence of OCS oil- and gas-related operations in areas where military operations are conducted. The stipulation contains a "hold harmless" clause (holding the U.S. Government harmless in case of an accident involving military operations) and requires lessees to coordinate their activities with appropriate local military contacts.

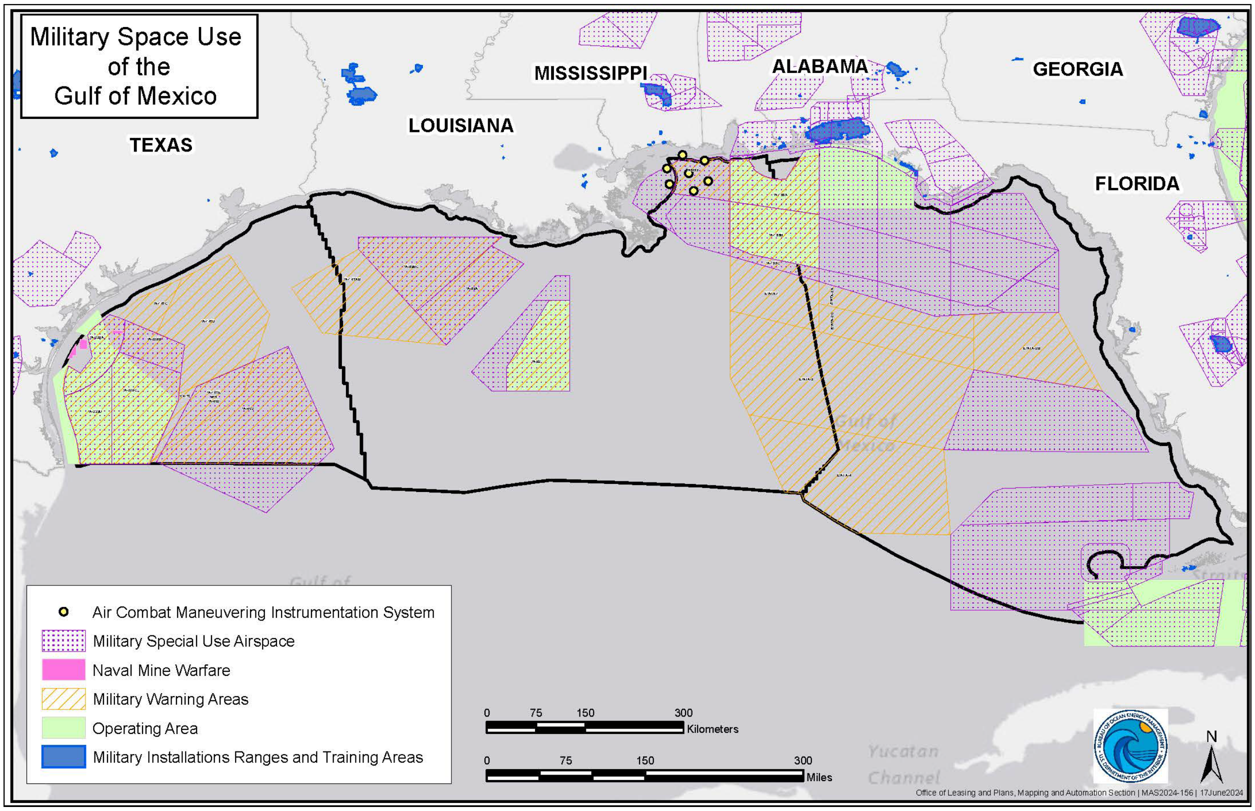

Figure F.2-1. Military Warning Areas and Eglin Water Test Areas in the Gulf of Mexico

F.2.2 Potential Stipulation Language

The potential stipulation reads as follows:

A. Hold and Save Harmless

Whether compensation for such damage or injury might be due under a theory of strict or absolute liability or otherwise, the lessee assumes all risks of damage or injury to persons or property that occur in, on, or above the Outer Continental Shelf (OCS), and to any persons or to any property of any person or persons who are agents, employees, or invitees of the lessee, its agents, independent contractors, or subcontractors doing business with the lessee in connection with any activities being performed by the lessee in, on, or above the OCS if such injury or damage to such person or property occurs by reason of the activities of any agency of the United States (U.S.) Government, its contractors or subcontractors, or any of its officers, agents, or employees, being conducted as a part of, or in connection with, the programs and activities of the command headquarters listed in the table in Section C, Operational.

Notwithstanding any limitation of the lessee's liability in Section 14 of the lease, the lessee assumes this risk whether such injury or damage is caused in whole or in part by any act or omission, regardless of negligence or fault, of the U.S. Government, its contractors or subcontractors, or any of its officers, agents, or employees. The lessee further agrees to indemnify and save harmless the U.S. Government against all claims for loss, damage, or injury sustained by the lessee, or to indemnify and save harmless the U.S. Government against all claims for loss, damage, or injury sustained by the agents, employees, or invitees of the lessee, its agents, or any independent contractors or subcontractors doing business with the lessee in connection with the programs and activities of the aforementioned military installation, whether the same be caused in whole or in part by the negligence or fault of the U.S. Government, its contractors or subcontractors, or any of its officers, agents, or employees, and whether such claims might be sustained under a theory of strict or absolute liability or otherwise.

B. Electromagnetic Emissions

The lessee agrees to control its own electromagnetic emissions and those of its agents, employees, invitees, independent contractors, or subcontractors emanating from individual designated defense warning areas in accordance with the requirements specified by the commander of the command headquarters listed in the following table to the degree necessary to prevent damage to, or unacceptable interference with, Department of Defense flight, testing, or operational activities conducted within individual designated warning areas. Necessary monitoring, control, and coordination with the lessee, its agents, employees, invitees, independent contractors, or subcontractors will be affected by the commander of the appropriate onshore military installation conducting operations in the particular warning area, provided, however, that control of such electromagnetic emissions shall in no instance prohibit all manner of electromagnetic communication during any period of time between a lessee, its agents, employees, invitees, independent contractors, or subcontractors, and onshore facilities.

C. Operational

The lessee, when operating, or causing to be operated on its behalf, a boat, ship, or aircraft traffic in an individual designated warning area, must enter into an agreement with the commander of the individual command headquarters listed in the following list, prior to commencing such traffic. Such an agreement will provide for positive control of boats, ships, and aircraft operating in the warning areas at all times.

Warning and Water Test Area	Command Address	Contact(s)	Email	Phone
W-59	Naval Air Station JRB 159 Fighter Wing 400 Russell Avenue, Box 27 Building 285 (Operations) New Orleans, Louisiana 70143-0027	TSgt. Michael Frisard TSgt. Russhelle Gremillion	michael.j.frisard.mil@mail.mil rushelle.gremillion@us.af.mil	(504) 391-8637 (504) 391-8637
W-92	Fleet Area Control and Surveillance Facility Attention: Deputy Airspace Officer 118 Albemare Ave. P.O. Box 40 Jacksonville, Florida 32212	Ronald McNeal	ronald.mcNeal@navy.mil	(904) 542-2112
W-147	147 OSS/OSA 14657 Sneider Street Houston, Texas 77034-5586	Sgt. Dion Folley	dion.r.folley.mil@mail.mil	(281) 929-2142
W-155	NASP Sector Control Attention: Facility (FACSFAC) NAS Pensacola 1860 Perimeter Road, Building 3963 NASP Florida 32508-5217	Facility (FACSFAC) NAS	NASP.SECTORCONTROL@navy.mil	(850) 452-2735 Base Operations: (850) 452-2431
W-228	Chief, Naval Air Training Code N386 (ATC and Air Space Management) Naval Air Station Corpus Christi, Texas 78419-5100	Tom Bily	thomas.bily@navy.mil	(361) 961-0145
W-453	Air National Guard – CRTC 4715 Hewes Avenue, Building 60 Gulfport, Mississippi 39507-4324	MSGT Crystal Bennoch Paul Parenteau	crystal.bennoch.1@us.af.mil paul.parenteau.1@us.af.mil	(228) 214-6027

Warning and Water Test Area	Command Address	Contact(s)	Email	Phone
W-602	VQ-4 Operations Department 7791 Mercury Road Tinker AFB, Oklahoma 73145-8704		TNKR_VQ4_Dep_Skeds@navy.mil	(405) 739-5700
Eglin Water Test Areas 1, 2, 3, and 4	101 West D Ave, Bldg. 1, Suite 116 Eglin AFB, Florida 32562 Range and Operations Sustainment Section 96 TW/XPO Eglin AFB, Florida 32542	Steven C. Dietzius, Technical Director (96TW/CT) Mr. Charles Smith	 charles.smith.7@us.af.mil	(850) 882-0762 (850) 882-5614

F.2.3 Effectiveness of the Lease Stipulation

The hold harmless section of the military stipulation serves to protect the U.S. Government from liability in the event of an accident involving the lessee and military activities. This serves to reduce the impact of OCS oil- and gas-related activity on the communications of military missions and reduces the possible impacts of electromagnetic energy transmissions on missile testing, tracking, and detonation. The operations of the military and the lessee and its agents will not be affected by this section.

The operational section requires notification to the military of OCS oil- and gas-related activity to take place within a military use area. This allows the base commander to plan military missions and maneuvers that will avoid the areas where OCS oil- and gas-related activities are taking place or to schedule around these activities. Prior notification helps reduce the potential impacts associated with vessels and helicopters traveling unannounced through areas where military activities are underway.

This stipulation reduces potential impacts, particularly in regard to safety, but it does not reduce or eliminate the actual physical presence of OCS oil- and gas-related operations in areas where military operations are conducted. The reduction in potential impacts resulting from this stipulation makes multiple-use conflicts between military operations and OCS oil- and gas-related activities unlikely. Without the stipulation, some potential conflict is likely. The best indicator of the overall effectiveness of the stipulation may be that there has never been an accident involving a conflict between military operations and OCS oil- and gas-related activities.

F.3 STIPULATION NO. 2 – EVACUATION

F.3.1 Stipulation Overview

Stipulation No. 2 may be included in leases issued as a result of an OCS oil and gas lease sale located in the easternmost portion of the Central Planning Area (CPA) and any blocks leased in the Eastern Planning Area (EPA). An evacuation stipulation has been applied to all blocks leased in these areas since 2001. The Evacuation Stipulation is designed to protect the lives and welfare of offshore oil and gas personnel. The OCS oil- and gas-related activities have the potential to occasionally interfere with specific requirements and operating parameters for the lessee's activities in accordance with the military stipulation clauses contained herein. If it is determined that the operations will result in interference with scheduled military missions in such a manner as to possibly jeopardize the national defense or to pose unacceptable risks to life and property, then a temporary suspension of operations and the evacuation of personnel may be necessary.

F.3.2 Potential Stipulation Language

A. The lessee, recognizing that oil and gas resource exploration, exploitation, development, production, abandonment, and site cleanup operations on the leased area of submerged lands may occasionally interfere with tactical military operations, hereby recognizes and agrees that the United States reserves and has the right to temporarily suspend operations and/or require evacuation on this lease in the interest of national security. Such suspensions are considered unlikely in this area. Every effort will be made by the appropriate military agency to provide as much advance notice as possible of the need to suspend operations and/or evacuate. Advance notice of fourteen (14) days normally will be given before requiring a suspension or evacuation, but in no event will the notice be less than four (4) days.

   Temporary suspension of operations may include the evacuation of personnel and appropriate sheltering of personnel not evacuated. Appropriate shelter means the protection of all lessee personnel for the entire duration of any Department of Defense activity from flying or falling objects or substances; it will be implemented by a written order from the Bureau of Safety and Environmental Enforcement (BSEE) Gulf of Mexico Regional Supervisor for District Field Operations (RSDFO), after consultation with the appropriate command headquarters or other appropriate military agency or higher authority.

   The appropriate command headquarters, military agency, or higher authority will provide information to allow the lessee to assess the degree of risk, and provide sufficient protection for, the lessee's personnel and property. Such suspensions or evacuations for national security reasons normally will not exceed seventy-two (72) hours; however, any such suspension may be extended by order of the BSEE Gulf of Mexico RSDFO. During such periods, equipment may remain in place, but all production, if any, must cease for the duration of the temporary suspension if the BSEE Gulf of Mexico RSDFO so directs. Upon cessation of any temporary suspension, the BSEE Gulf of Mexico RSDFO immediately will notify the lessee that such suspension has terminated and operations on the leased area can resume.

B. The lessee must inform BSEE of the persons/offices to be notified to implement the terms of this stipulation.

C. The lessee is encouraged to establish and maintain early contact and coordination with the appropriate command headquarters to avoid or minimize the effects of conflicts with potentially hazardous military operations.

D. The lessee is not entitled to reimbursement for any costs or expenses associated with the suspension of operations or activities or the evacuation of property or personnel in fulfillment of the military mission in accordance with subsections A through C above.

E. Notwithstanding subsection D, the lessee reserves the right to seek reimbursement from appropriate parties for the suspension of operations or activities, or the evacuation of property or personnel, associated with conflicting commercial operations.

F.3.3 Effectiveness of the Lease Stipulation

This stipulation would provide for the evacuation of personnel and shut-in of operations during any events conducted by the military that could pose a danger to ongoing OCS oil- and gas-related operations. It is expected that the invocation of these evacuation requirements would be extremely rare. It is expected that these measures would eliminate dangerous conflicts between OCS oil- and gas-related activities and military operations. Continued close coordination between BSEE and the military may result in improvements in the wording and implementation of these stipulations.

F.4 Stipulation No. 3 – Coordination

F.4.1 Stipulation Overview

Stipulation No. 3 may be included in leases issued as a result of an OCS oil and gas lease sale located in the easternmost portion of the CPA or any blocks leased in the EPA. A coordination stipulation has been applied to all blocks leased in these areas since 2001. The Coordination Stipulation is designed to increase communication and cooperation between military authorities and offshore oil and gas operators. Specific requirements and operating parameters are established for the lessee's activities in accordance with the Military Areas Stipulation clauses. For instance, if it is determined that the operations will result in interference with scheduled military missions in such a manner as to possibly jeopardize the national defense or to pose unacceptable risks to life and property, then certain measures become activated and the OCS oil- and gas-related operations may be curtailed in the interest of national defense.

F.4.2 Potential Stipulation Language

A. The placement, location, and planned periods of operation of surface structures on this lease during the exploration stage are subject to approval by the Bureau of Ocean Energy Management (BOEM) Gulf of Mexico Regional Director (RD) after the review of an operator's Exploration Plan (EP). Prior to approval of the EP, the lessee must consult with the appropriate command headquarters regarding the location, density, and planned periods of operation of such structures, and to maximize exploration while minimizing conflicts with Department of Defense activities.

   When determined necessary by the appropriate command headquarters, the lessee will enter into a formal Operating Agreement with such command headquarters, which delineates the specific requirements and operating parameters for the lessee's activities in accordance with the military stipulation clauses contained herein. If it is determined that the operations will result in interference with scheduled military missions in such a manner as to possibly jeopardize national defense or to pose unacceptable risks to life and property, then the BOEM Gulf of Mexico RD may approve the EP with conditions, disapprove it, or require modification in accordance with 30 CFR part 550. The BOEM Gulf of Mexico RD will notify the lessee in writing of the conditions associated with plan approval, or the reason(s) for disapproval or required modifications.

   Moreover, if there is a serious threat of harm or damage to life or property, or if it is in the interest of national security or defense, pending or approved operations may be suspended or halted in accordance with 30 CFR part 250. Such a suspension will extend the term of a lease by an amount equal to the length of the suspension. The Bureau of Safety and Environmental Enforcement (BSEE) Gulf of Mexico RD will attempt to minimize such suspensions within the confines of related military requirements. It is recognized that the issuance of a lease conveys the right to the lessee, as provided in Section 8(b)(4) of the Outer Continental Shelf Lands Act (OCSLA), 43 U.S.C. § 1337(b)(4), to engage in exploration, development, and production activities conditioned upon other statutory and regulatory requirements.

B. The lessee is encouraged to establish and maintain early contact and coordination with the appropriate command headquarters to avoid or minimize the effects of conflicts with potentially hazardous military operations.

C. If national security interests are likely to be in continuing conflict with an existing Operating Agreement, EP, Development and Production Plan, or Development Operations Coordination Document, the BSEE Gulf of Mexico RD, in consultation with BOEM, will direct the lessee to modify any existing Operating Agreement or to enter into a new Operating Agreement to implement measures to avoid or minimize the identified potential conflicts, subject to the terms and conditions and obligations of the legal requirements of the lease.

F.4.3 Effectiveness of the Lease Stipulation

This stipulation would provide for review of pending oil and gas operations by military authorities and could result in delaying oil and gas operations if military activities have been scheduled in the area that may put the oil and gas operations and personnel at risk or if such operations could result in serious threat of harm or damage to life or property, or jeopardize national security or defense.

F.5 STIPULATION NO. 4 – PROTECTED SPECIES

F.5.1 Stipulation Overview

Stipulation No. 4 may be included in all leases issued as a result of an OCS oil and gas lease sale. A Protected Species Stipulation has been applied to all blocks leased in the GOM since December 2001. This stipulation was developed in consultation with the U.S. Department of Commerce, National Oceanic and Atmospheric Administration (NOAA), National Marine Fisheries Service and the U.S. Department of the Interior, Fish and Wildlife Service in accordance with consultation requirements under the Endangered Species Act and Marine Mammal Protection Act, and is designed to minimize or avoid potential adverse impacts to federally protected species under both Acts. The version of the stipulation applied at the leasing stage would reflect the current requirements for compliance.

F.5.2 Potential Stipulation Language

A. The Endangered Species Act (16 U.S.C. §§ 1531 *et seq*.) and the Marine Mammal Protection Act (MMPA) (16 U.S.C. §§ 1361 *et seq*.) are designed to protect threatened and endangered species and marine mammals and apply to activities authorized under the Outer Continental Shelf Lands Act (OCSLA, 43 U.S.C. §§ 1331 *et seq*.). The Congressional Declaration of Policy included in OCSLA provides that it is the policy of the United States that the OCS should be made available for expeditious and orderly development, subject to environmental safeguards, in a manner that is consistent with the maintenance of competition and other national needs (see 43 U.S.C. § 1332). Both the Bureau of Ocean Energy Management (BOEM) and the Bureau of Safety and Environmental Enforcement (BSEE) comply with these laws on the OCS.

B. The lessee and its operators must:

1. Comply with the Reasonable and Prudent Measures and implementing Terms and Conditions of the Biological Opinion issued by the National Marine Fisheries Service (NMFS) on March 13, 2020 (NMFS 2020), as amended. This includes mitigation, particularly any appendices to Terms and Conditions applicable to the activity, as well as record-keeping and reporting sufficient to allow BOEM and BSEE to comply with reporting and

monitoring requirements under the BiOp; and any additional reporting required by BOEM or BSEE developed as a result of implementation of the 2020 NMFS BiOp and 2021 Amended Incidental Take Statement (ITS) and Revised Appendices.

- The 2020 NMFS BiOp may be found here: https://www.fisheries.noaa.gov/resource/document/biological-opinion-federally-regulated-oil-and-gas-program-activities-gulf-mexico
- The Appendices and protocols may be found here: https://www.fisheries.noaa.gov/resource/document/appendices-biological-opinion-federally-regulated-oil-and-gas-program-gulf-mexico
- The 2021 Amended ITS and Revised Appendices may be found here: https://www.fisheries.noaa.gov/resource/document/amended-incidental-take-statement-and-revised-appendices

2. Immediately report all sightings and locations of injured or dead protected species (e.g., marine mammals and sea turtles) to the appropriate hotlines listed at https://www.fisheries.noaa.gov/report (phone numbers vary by state) as required in the 2020 NMFS BiOp and 2021 Revised Appendix C. If oil and gas industry activity is responsible for the injured or dead animal (e.g., injury or death was caused by a vessel strike, entrapment or entanglement), the responsible parties must notify BOEM and BSEE within 24 hours of the strike or entrapment/entanglement by email to protectedspecies@boem.gov and protectedspecies@bsee.gov, respectively.

3. Unless previously approved by BOEM or BSEE through a plan or permit issued under this lease, notify BOEM at least 15 days prior to any proposed vessel transit of the Rice's whale area, and receive prior approval for that transit from BOEM. The Rice's whale area, as described in the 2020 NMFS BiOp, includes the area from 100- to 400-meter isobaths from 87.5° W to 27.5° N as described in the status review (Rosel et al. 2016), plus an additional 10 km around that area.

The lessee and its operators, personnel, and subcontractors, while undertaking activities authorized under this lease, must implement and comply with the specific mitigation measures outlined in the following Appendices of the 2020 NMFS BiOp and 2021 Amended ITS and Revised Appendices:

- Appendix A: "Seismic Survey Mitigation and Protected Species Observer Protocols";
- Appendix B: "Gulf of Mexico Marine Trash and Debris Awareness and Elimination Survey Protocols";

- Appendix C: "Vessel Strike Avoidance and Injured/Dead Aquatic Protected Species Reporting Protocols";
- Appendix I: "Explosive Removal of Structure Measures"; and
- Appendix J: "Sea Turtle Handling and Resuscitation Guidelines".

Certain post-lease approvals (e.g., for activities proposing new and unusual technologies, certain seismic surveys) will require step-down review by NMFS, as provided by the 2020 NMFS BiOp and 2021 Amended ITS, and additional mitigations to protect ESA-listed species may be applied at that time. At the lessee's option, the lessee, its operators, personnel, and contractors may comply with the most current measures to protect species in place at the time an activity is undertaken under this lease, including but not limited to, new or updated versions of the 2020 NMFS BiOp, the 2021 ITS and Appendices, or through new or activity-specific consultations. The most current applicable terms and conditions and reasonable and prudent measures from the 2020 NMFS BiOp, 2021 Amended ITS and Appendices, or other relevant consultations will be applied to post-lease approvals. The lessee and its operators, personnel, and subcontractors will be required to comply with the mitigation measures identified in the above referenced 2020 NMFS BiOp and 2021 Amended ITS (including Appendices), and additional measures in the conditions of approvals for their plans or permits.

F.5.3 Effectiveness of the Lease Stipulation

This stipulation was developed in consultation with NMFS and FWS, and is designed to minimize or avoid potential adverse impacts to federally protected species. The stipulation immediately implements existing mitigations on post-lease activities and notifies lessees that subsequent approvals for OCS oil- and gas-related activities may include additional mitigations (as conditions of approval) when those actions have the potential to impact marine mammals, sea turtles, and other federally protected species. Among other protections, these requirements and conditions provide protection by ensuring that operations are conducted at least a minimum distance away from the animal.

F.6 STIPULATION NO. 5 – TOPOGRAPHIC FEATURES

F.6.1 Stipulation Overview

High-relief topographic features that provide habitat for coral-reef-community organisms are located in the Western Planning Area (WPA) and CPA. BOEM protects these features from OCS oil- and gas-related activities through stipulations attached to leases. There are currently no identified topographic features protected under this stipulation in the EPA.

The OCS oil- and gas-related activities resulting from an OCS oil and gas lease sale could have potentially severe impacts on or near hard bottom communities in the GOM. The U.S. Department of the Interior has recognized this issue and has made the Topographic Features

Stipulation part of leases on or near these biotic communities since 1973 to mitigate potential impacts. By applying the stipulation, potential impacts from nearby OCS oil- and gas-related activities are substantially mitigated. This stipulation does not prevent the recovery of oil and gas resources, but it would serve to protect valuable and sensitive biological resources.

Because this stipulation has been applied as programmatic mitigation in the 2024-2029 National OCS Oil and Gas Program Programmatic EIS (BOEM 2023a) and Record of Decision (BOEM 2023b), it would apply to all leases issued for GOM lease sales under the 2024-2029 National OCS Oil and Gas Program in designated lease blocks within the areas indicated in **Figure F.6-2**. The detailed topographic features map package is available from BOEM's New Orleans Office, Public Information Office and on BOEM's website at http://www.boem.gov/Topographic-Features-Stipulation-Map-Package/. BOEM policy, as it relates to the Topographic Features Stipulation, is described in NTL No. 2009-G39, "Biologically-Sensitive Underwater Features and Areas," and can be found on BOEM's website at https://www.boem.gov/sites/default/files/regulations/Notices-To-Lessees/2009/09-G39.pdf. Specific OCS blocks affected by the Topographic Features Stipulation are listed on BOEM's website at https://www.boem.gov/sites/default/files/environmental-stewardship/Environmental-Studies/Gulf-of-Mexico-Region/topoblocks.pdf. A detailed map showing the locations of the affected blocks can be found on BOEM's website at https://www.boem.gov/sites/default/files/environmental-stewardship/Environmental-Studies/Gulf-of-Mexico-Region/topomap.pdf.

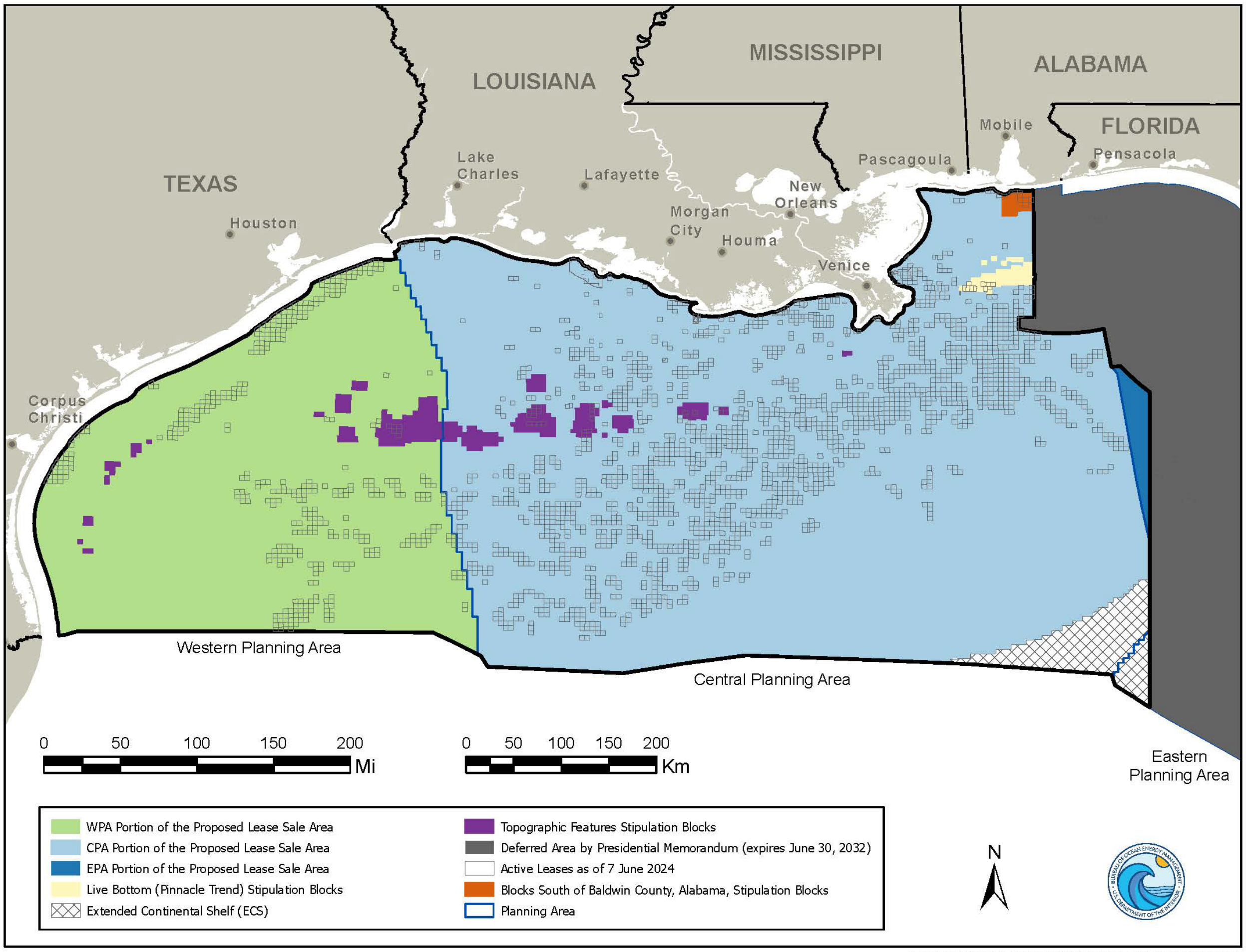

Figure F.6-2. Blocks That Could Be Subject to the Topographic Features Stipulation, Live Bottom Stipulation, or the Blocks South of Baldwin County, Alabama, Stipulation in the Gulf of Mexico Overlaid with Potential Lease Sale Areas of the Gulf of Mexico.

The Topographic Features Stipulation was formulated based on consultation with various Federal agencies and comments solicited from the States, industry, environmental organizations, and academic representatives. The stipulation is based on years of scientific information collected since the inception of the stipulation. This information includes various Bureau of Land Management/MMS (BOEM)-funded studies of topographic highs in the GOM; numerous stipulation-imposed, industry-funded monitoring reports; and the National Research Council's report entitled *Drilling Discharges in the Marine Environment* (National Research Council 1983). The blocks affected by the previously applied Topographic Features Stipulation are shown in **Figure F.6-2**.

This stipulation would establish No Activity Zones at the topographic features where no bottom-disturbing activity, including anchoring and structure emplacement, would be allowed. The No Activity Zone would protect the most sensitive reef biota that are found at the peaks of the topographic features within the No Activity Zone. Each bank-specific No Activity Zone is described in the table in **Appendix F.6.2** below. Outside the No Activity Zone, additional restrictive buffer zones based on an essential fish habitat programmatic consultation with NOAA Fisheries would be established to distance OCS oil- and gas-related, bottom-disturbing activities from the No Activity Zone. Oil and gas operations could occur within these buffer zones, but drilling discharges would be shunted to near the seafloor within the zones. Shunting of the drilling effluent to near the seafloor allows cuttings to be discharged deeper than the portions of the high-relief topographic feature where the most sensitive reef-building corals live. Low-relief banks would likely have a No Activity Zone and restrictive buffer zones surrounding the No Activity Zone, but they would not have a shunting requirement. Shunting near these low-relief banks would discharge drilling muds in the same water-depth range as the features' associated biota that are being protected and could potentially smother those features.

Three topographic features (i.e., the East Flower Garden Bank, West Flower Garden Bank, and Stetson Bank) have been withdrawn from leasing, as of the July 2008 Memorandum on Withdrawal of Certain Areas of U.S. OCS from Leasing Disposition, and are protected to a greater degree than the other topographic features, as outlined in the table in **Appendix F.6.2** below. Under BOEM's Topographic Features Stipulation and based on an essential fish habitat programmatic consultation with NOAA Fisheries, the added provisions at the East and West Flower Garden Banks include a larger and deeper No Activity Zone and a larger shunting zone (4 miles [mi]; 6 kilometers [km] surrounding the No Activity Zone) than the other BOEM-protected topographic features. Stetson Bank, which was made part of the Flower Garden Banks National Marine Sanctuary in 1996, does not have the same biological complexity as the East and West Flower Garden Banks, and therefore has similar No Activity Zone and shunting zone protections to the other BOEM-protected topographic features.

F.6.2 Potential Stipulation Language

The stipulation provides for protection of the following banks through the applicable mitigating measures in the Western Planning Area.

Bank Name	No Activity Zone (defined by isobaths in meters)
Shelf Edge Banks	
West Flower Garden Bank	100 (Defined by 1/4 x 1/4 x 1/4 system)
East Flower Garden Bank	100 (Defined by 1/4 x 1/4 x 1/4 system)
MacNeil Bank	82
29 Fathom Bank	64
Rankin Bank	85
Bright Bank[1]	85
Stetson Bank	52
Appelbaum Bank	85
Low-Relief Banks[2]	
Mysterious Bank	74, 76, 78, 80, 84
Coffee Lump	Various
Blackfish Ridge	70

Bank Name	No Activity Zone (defined by isobaths in meters)
Big Dunn Bar	65
Small Dunn Bar	65
32 Fathom Bank	52
Claypile Bank[3]	50
South Texas Banks[4]	
Dream Bank	78, 82
Southern Bank	80
Hospital Bank	70
North Hospital Bank	68
Aransas Bank	70
South Baker Bank	70
Baker Bank	70

Notes:
[1] Central Planning Area bank in the Gulf of Mexico with a portion of its "1-Mile Zone" and/or "3-Mile Zone" in the WPA.
[2] Only paragraph A applies.
[3] Paragraphs A and B apply. In paragraph B, monitoring of the effluent to determine the effect on the biota of Claypile Bank is required rather than shunting.
[4] Only paragraphs A and B apply.

The stipulation provides for protection of the following banks through the applicable mitigating measures in the Central Planning Area:

Bank Name	No Activity Zone (defined by isobaths in meters)
Alderdice Bank	80
Bouma Bank	85
Bright Bank[1]	85
Diaphus Bank[2]	85
Elvers Bank	85
Ewing Bank	85
Fishnet Bank[2]	76
Geyer Bank	85
Jakkula Bank	85
McGrail Bank	85
Parker Bank	85
Rezak Bank	85
Sackett Bank[2]	85
Sidner Bank	85
Sonnier Bank	55
Sweet Bank[3]	85

Notes:
[1] Gulf of Mexico CPA bank with a portion of its "3-Mile Zone" in the Gulf of Mexico Western Planning Area.

[2] Only paragraphs A and B apply.
[3] Only paragraph A applies.

The lessee and its operators, personnel, and subcontractors are responsible for carrying out the specific mitigating measures outlined in the most current Notice To Lessees and Operators (NTLs) as described at https://www.boem.gov/guidance, which provide guidance on how to follow the requirements of this stipulation (NTL No. 2009-G39). See the "Topographic Features Stipulation Map" and the figures in the "Western and Central Gulf of Mexico Topographic Features Stipulation Map package" on the Bureau of Ocean Energy Management website at http://www.boem.gov/Topographic-Features-Stipulation-Map-Package/. In addition to the foregoing, the lessee, its operators, personnel, and subcontractors, as applicable, shall comply with the following:

A. No activity, including the placement of structures, drilling rigs, pipelines, or anchoring, will be allowed within the listed isobath ("No Activity Zone") of the banks listed above.

B. Operations within the area shown as the "1,000-Meter Zone" on the "Topographic Features Stipulation Map" must be restricted by shunting all drill cuttings and drilling fluids to the bottom through a structurally sound downpipe that terminates at an appropriate distance, but no more than 10 meters, from the bottom.

C. Operations within the area shown as the "1-Mile Zone" on the "Topographic Features Stipulation Map" must be restricted by shunting all drill cuttings and drilling fluids to the bottom through a structurally sound downpipe that terminates at an appropriate distance, but no more than 10 meters, from the bottom. Where a "1-Mile Zone" is designated, the "1,000-Meter Zone" in paragraph B is not designated. This restriction on operations also applies to areas surrounding the Flower Garden Banks, namely the "4-Mile Zone" surrounding the East Flower Garden Bank and the West Flower Garden Bank.

D. Operations within the area shown as "3-Mile Zone" on the "Topographic Features Stipulation Map" (http://www.boem.gov/Topographic-Features-Stipulation-Map-Package/) must be restricted by shunting all drill cuttings and drilling fluids from development operations to the bottom through a structurally sound downpipe that terminates at an appropriate distance, but no more than 10 meters, from the bottom. If more than two exploration wells are to be drilled from the same surface location within the "3-Mile Zone," all drill cuttings and drilling fluids must be restricted by shunting to the bottom through a downpipe that terminates at an appropriate distance, but no more than 10 meters, from the bottom.

F.6.3 Effectiveness of the Lease Stipulation

The purpose of the stipulation is to protect the biota of the topographic features from adverse impacts due to routine OCS oil- and gas-related activities. Such impacts include physical damage from anchoring and rig emplacement and potential toxic and smothering impacts from muds and cuttings discharges. The Topographic Features Stipulation has been used on leases since 1973 to effectively prevent damage to the biota of these banks from routine OCS oil- and gas-related activities. Anchoring related to OCS oil- and gas-related activities on the sensitive portions of the topographic features has been prevented. Monitoring studies have demonstrated that the shunting requirements of the stipulations are effective in preventing the muds and cuttings from impacting the biota of the banks. Long-term monitoring studies conducted by NOAA and BOEM at the East and West Flower Garden Banks have shown that no significant long-term changes have been detected in coral cover or coral diversity at the East and West Flower Garden Banks from 1988 to 2017 (Johnston et al. 2013; 2015; 2018; Zimmer et al. 2010) and probably not since the first measurements were taken in the mid-1970s (Gittings 1998). The stipulation, which is applied as programmatic mitigation in the 2024-2029 National OCS Oil and Gas Program Programmatic EIS (BOEM 2023a) and Record of Decision (BOEM 2023b) would apply to all leases issued under the 2024-2029 National OCS Oil and Gas Program in designated lease blocks in designated lease blocks, will continue to protect the biota of the banks by substantially mitigating OCS oil- and gas-related activities. This stipulation does not prevent the recovery of oil and gas resources but would serve to protect valuable and sensitive biological resources.

F.7 Stipulation No. 6 – United Nations Convention on the Law of the Sea Royalty Payment

F.7.1 Stipulation Overview

Stipulation No. 6 could be included in leases issued as a result of a lease sale in the WPA and CPA in the area beyond the U.S. Exclusive Economic Zone, formerly known as the “Western Gap” (**Figure F.7-1**).

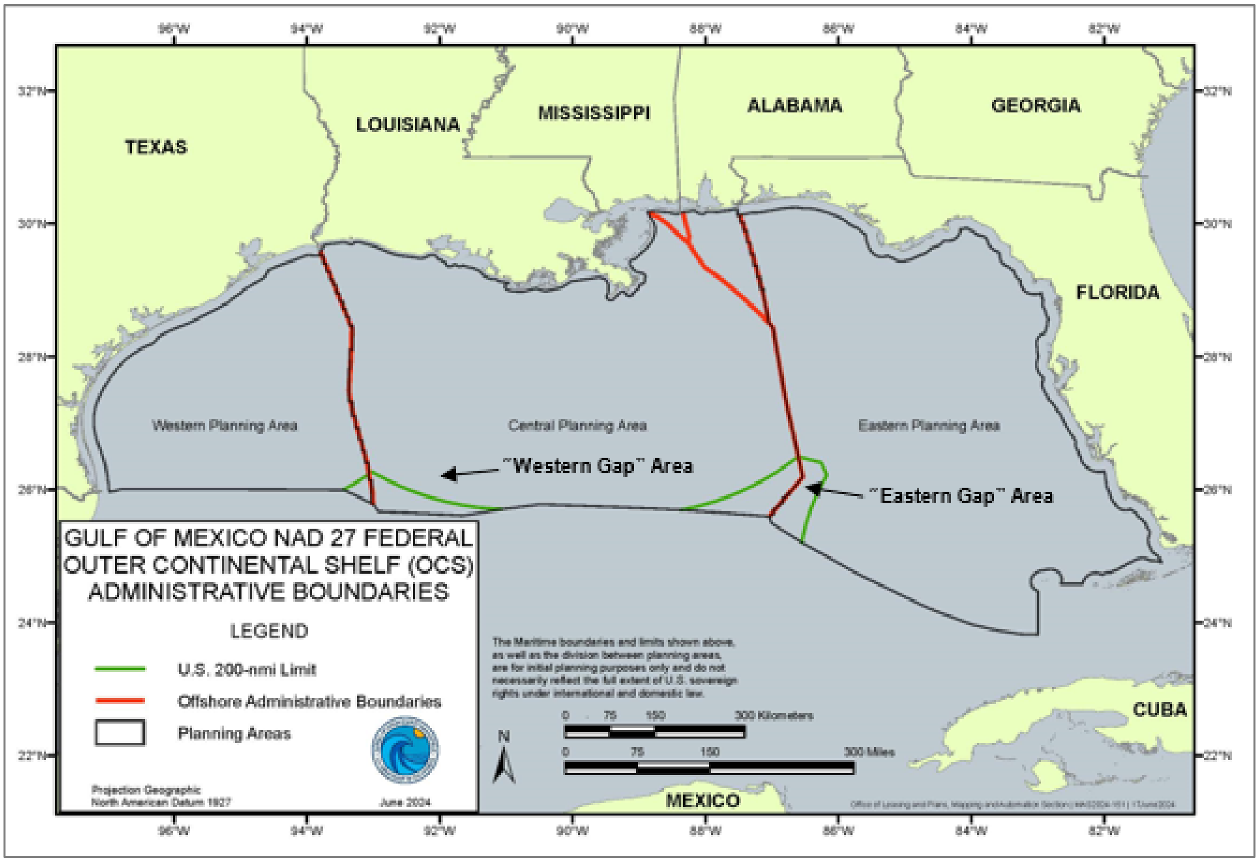

Figure F.7-1. Gulf of Mexico OCS Administrative Boundaries, the "Western Gap" Area, and the "Eastern Gap" Area.

F.7.2 Potential Stipulation Language

If the United States of America becomes a party to the 1982 United Nations Convention on the Law of the Sea (UNCLOS, or Convention) prior to or during the life of a lease issued by the U.S. Government on a block or portion of a block located beyond its Exclusive Economic Zone as defined in UNCLOS, and subject to such conditions that the Senate may impose through its constitutional role of advice and consent, then the following royalty payment lease provisions will apply to the lease so issued, consistent with Article 82 of UNCLOS:

A. UNCLOS requires annual payments by coastal states party to the Convention with respect to all production at a site after the first five years of production at that site. Any such payments will be made by the U.S. Government and not the lessee.

B. For the purpose of this stipulation regarding payments by the lessee to the U.S. Government, each lease constitutes a separate site, whether or not a lease is committed to a unit.

C. For the purpose of this stipulation, the first production year begins on the first day of commercial production (excluding test production). Once a production year begins, it will run for a period of 365 days, whether or not the lease produces continuously in commercial quantities. Subsequent production years will begin on the anniversary date of first production.

D. If total lease production during the first five years following first production exceeds the total royalty suspension volume(s) provided in the lease terms, or through application and approval of relief from royalties, the provisions of this stipulation will not apply. If, after the first five years of production, but prior to termination of this lease, production exceeds the total royalty suspension volume(s) provided in the lease terms, or through application and approval of relief from royalties, the provisions of this stipulation no longer will apply effective the day after the suspension volumes have been produced.

E. If, in any production year after the first five years of lease production, due to lease royalty suspension provisions or through application and approval of relief from royalties, no lease production royalty is due or payable by the lessee to the U.S. Government, then the lessee will be required to pay, as stipulated in paragraph 1 below, UNCLOS-related royalty in the following amount so that the required Convention payments may be made by the U.S. Government as provided under the Convention:

   1. In the sixth year of production, one percent of the value of the sixth year's lease production saved, removed, or sold from the leased area;

   2. After the sixth year of production, the Convention-related royalty payment rate will increase by one percent for each subsequent year until the twelfth year and will remain at seven percent thereafter until lease termination.

F. If the United States becomes a party to UNCLOS after the fifth year of production from the lease, and a lessee is required, as provided herein, to pay UNCLOS-related royalty, the amount of the royalty due will be based on the above payment schedule as determined from first production. For example, the U.S. Government's accession to UNCLOS in the tenth year of lease production would result in an UNCLOS-related royalty payment of five percent of the value of the tenth year's lease production, saved, removed, or sold from the lease. The following year, a payment of six percent would be due and so forth, as stated above, up to a maximum of seven percent per year.

G. If, in any production year after the first five years of lease production, due to lease royalty suspension provisions or through application and approval of relief from royalties, lease production royalty is paid but is less than the payment provided for by the Convention, then the lessee will be required to pay to the U.S. Government the Convention-related royalty in the amount of the shortfall.

H. In determining the value of production from the lease if a payment of Convention-related royalty is to be made, the provisions of the lease and applicable regulations will apply.

I. The UNCLOS-related royalty payment(s) required under paragraphs E through G of this stipulation, if any, will not be paid monthly but will be due and payable to the Office of Natural Resources Revenue on or before 30 days after expiration of the relevant production lease year.

J. The lessee will receive royalty credit in the amount of the UNCLOS-related royalty payment required under paragraphs E through G of this stipulation, which will apply to royalties due under the lease for which the Convention-related royalty accrued in subsequent periods as non-Convention-related royalty payments become due.

K. Any lease production for which the lessee pays no royalty other than a Convention-related requirement, due to lease royalty suspension provisions or through application and approval of relief from royalties, will count against the lease's applicable royalty suspension or relief volume.

L. The lessee will not be allowed to apply or recoup any unused UNCLOS-related royalty credit(s) associated with a lease that has been relinquished or terminated.

F.7.3 Effectiveness of the Lease Stipulation

The purpose of the stipulation is to provide guidance on royalty payment lease provisions, which will apply to the lease so issued, consistent with Article 82 of UNCLOS, should the United States of America become a party to the 1982 United Nations Convention on the Law of the Sea (UNCLOS, or Convention) prior to or during the life of a lease issued by the U.S. Government on a block or portion of a block located beyond its Exclusive Economic Zone as defined in UNCLOS.

F.8 STIPULATION NO. 7 – AGREEMENT BETWEEN THE UNITED STATES OF AMERICA AND THE UNITED MEXICAN STATES CONCERNING TRANSBOUNDARY HYDROCARBON RESERVOIRS IN THE GULF OF MEXICO

F.8.1 Stipulation Overview

Stipulation No. 7 could be included in leases issued as a result of future OCS oil and gas lease sales that are wholly or partially located within 3 statute miles (2.6 nautical miles [nmi]; 3 miles [mi]; 4.8 kilometers [km]) of the Maritime and Continental Shelf Boundary with Mexico, commonly referred to as the "Western Gap" (**Figure F.7-1**). The Western Gap area is comprised of any and all blocks in the WPA and CPA that are wholly or partially located within 3 statute miles (2.6 nmi; 3 mi; 4.8 km) of the Maritime and Continental Shelf Boundary with Mexico, as the Maritime Boundary is delimited in the Treaty to Resolve Pending Boundary Differences and Maintain the Rio Grande and the Colorado River as the International Boundary, signed November 24, 1970; the Treaty on Maritime Boundaries between the United Mexican States and the United States of America, signed on May 4, 1978; and, as the continental shelf in the western Gulf of Mexico beyond 200 nmi (230 mi; 370 km) is delimited in the Treaty between the Government of the United Mexican States and the Government of the United States of America, signed on June 9, 2000.

F.8.2 Potential Stipulation Language

The *Agreement between the United States of America and the United Mexican States Concerning Transboundary Hydrocarbon Reservoirs in the Gulf of Mexico* (Agreement), signed on February 20, 2012, entered into force on July 18, 2014. All activities carried out under this lease must comply with the Agreement and any law, regulation, or condition of approval of a unitization agreement, plan, or permit adopted by the United States to implement the Agreement before or after issuance of this lease. The lessee is subject to, and must comply with, all terms of the Agreement, including, but not limited to, the following requirements:

A. When the United States is obligated under the Agreement to provide information that may be considered confidential, commercial, or proprietary to a third-party or the Government of the United Mexican States, if the lessee holds such information, the lessee is required to provide it to the lessor as provided for in the Agreement;

B. When the United States is obligated under the Agreement to prohibit commencement of production on a lease, Bureau of Safety and Environmental Enforcement (BSEE) will direct a Suspension of Production with which the lessee must comply;

C. When the United States is obligated under the Agreement to seek development of a transboundary reservoir under a unitization agreement, the lessee is required to cooperate and explore the feasibility of such a development with a licensee of the United Mexican States;

D. When there is a proven transboundary reservoir, as defined by the Agreement, and the relevant parties, including the lessee, fail to conclude a unitization agreement, the lessee's rights to produce the hydrocarbon resources will be limited by the terms of the Agreement;

E. If the lessee seeks to jointly explore or develop a transboundary reservoir with a licensee of the United Mexican States, the lessee is required to submit to BSEE information and documents that comply with and contain terms consistent with the Agreement, including, but not limited to, a Proposed unitization agreement that designates the unit operator for the transboundary unit and provides for the allocation of production and any redetermination of the allocation of production; and

F. The lessee is required to comply with and abide by determinations issued as a result of the Agreement's dispute resolution process on, among other things, the existence of a transboundary reservoir, and the allocation and/or reallocation of production.

The lessee and its operators, personnel, and subcontractors are required to comply with these and any other additional measures necessary to implement the provisions of the Agreement, including, but not limited to, conditions of approval for their plans and permits for activities related to any transboundary reservoir or geologic structure subject to the Agreement.

A copy of the Agreement is attached to this lease. The lessee accepts the risk that a provision of the Agreement or any United States law, regulation, or condition of approval of a unitization agreement, plan, or permit implementing the Agreement may increase or decrease the lessee's obligations and rights under the lease. The summary of provisions of the Agreement set forth above is provided for the lessee's reference. To the extent this summary differs or conflicts with the express language of the Agreement or implementing regulations, the provisions of the Agreement and regulations are incorporated by reference in their entirety and will control and be enforceable as binding provisions of this lease.

F.8.3 Effectiveness of the Lease Stipulation

The Transboundary Agreement removes uncertainties regarding development of transboundary resources in the resource-rich Gulf of Mexico. As a result of the Agreement, nearly 1.5 million acres of the OCS would be made more accessible for exploration and production activities. BOEM's estimates indicate that this area contains as much as 172 million barrels of oil and 304 billion cubic feet of natural gas. The Agreement also opens up resources in the Western Gap that were off limits to both countries under a previous treaty that imposed a moratorium along the boundary. The Transboundary Agreement sets clear guidelines for the development of oil and natural gas reservoirs that cross the maritime boundary. Under the Agreement, U.S. companies and Petróleos Mexicanos (PEMEX) would be able to voluntarily enter into agreements to jointly develop those reservoirs. In the event that consensus cannot be reached, the Transboundary Agreement establishes the process through which U.S. companies and PEMEX can individually develop the resources on each side of the border while protecting each nation's interests and resources.

F.9 Stipulation No. 8 – Live Bottom

F.9.1 Stipulation Overview

BOEM protects live bottoms in the GOM through two stipulations attached to leases, as well as through post-lease conditions of approvals attached to permits. BOEM defines "live bottom areas" as seagrass communities or those areas that contain biological assemblages consisting of such sessile invertebrates as sea fans, sea whips, hydroids, anemones, ascidians, sponges, bryozoans, or corals living upon and attached to naturally occurring hard or rocky formations with rough, broken, or smooth topography; or areas whose lithotope favors the accumulation of turtles, fishes, and other fauna. Live bottom features may include pinnacle trend features, low-relief features, or potentially sensitive biological features (PSBFs). Protective measures have been developed over time based on the nature and sensitivity of these various live bottom habitats and their associated communities, as understood from decades of BOEM-funded and other environmental studies. These protections were developed into two stipulations, the Live Bottom (Pinnacle Trend) Stipulation and the Live Bottom (Low-Relief) Stipulation, as discussed below. These stipulations have historically been applied to OCS leases in areas with known concentrations of these live bottom features.

The two Live Bottom Stipulations are intended to protect hard bottom habitat and their associated live bottom communities from damage and, at the same time, provide for recovery of potential oil and gas resources nearby. The PSBFs, which are found throughout the GOM, are not protected by lease stipulations but are protected by mitigations that are attached as conditions of approval to permits at the post-lease review stage. BOEM policy as it relates to these lease stipulations and post-lease mitigations is described in NTL No. 2009-G39, "Biologically-Sensitive Underwater Features and Areas," and can be found on BOEM's website at https://www.boem.gov/sites/default/files/regulations/Notices-To-Lessees/2009/09-G39.pdf. Specific OCS blocks affected by the Live Bottom Stipulations are listed on BOEM's website at https://www.boem.gov/sites/default/files/environmental-stewardship/Environmental-Studies/Gulf-of-Mexico-Region/topoblocks.pdf. A detailed map showing the locations of the affected blocks can be found on BOEM's website at https://www.boem.gov/sites/default/files/environmental-stewardship/Environmental-Studies/Gulf-of-Mexico-Region/topomap.pdf.

The Pinnacle Trend is located offshore Mississippi and Alabama in the northeastern CPA. The pinnacles are a series of topographic irregularities with variable biotal coverage, which provide structural habitat for a variety of pelagic fish. The pinnacles would be classified as live bottom under the Live Bottom Stipulation. The Live Bottom (Pinnacle Trend) Stipulation has been routinely applied to appropriate CPA oil and gas lease sales since 1974 to protect the known Pinnacle Trend features in the CPA. The Live Bottom (Pinnacle Trend) Stipulation, which is applied as programmatic mitigation in the 2024-2029 National OCS Oil and Gas Program Programmatic EIS (BOEM 2023a) and Record of Decision (BOEM 2023b), would apply to all leases issued under the 2024-2029 National OCS Oil and Gas Program in designated lease blocks and, therefore, would be included on leases on 74 OCS lease blocks in the northeastern CPA, including the Main Pass Area, South and East Addition Blocks 190, 194, 198, 219-226, 244-266, 276-290; Viosca Knoll Area Blocks 473-476, 521, 522, 564, 565, 566, 609, 610, 654, 692-698, 734, 778; and Destin Dome Area Blocks 577, 617, 618, and 661 (refer to **Figures F.6-2 and F.9-1**). Within the Live Bottom (Pinnacle Trend) Stipulation blocks, no bottom-disturbing activities may occur within 30 meters (m) (100 feet [ft]) of any hard bottom/pinnacles that have a vertical relief of 8 ft (2 m) or more. A bottom survey report showing pinnacle location and proposed bottom-disturbing activity will be required as part of any permit application to ensure that sensitive seafloor features are avoided.

Live bottom (low-relief) features are seagrass communities; areas that contain biological assemblages consisting of sessile invertebrates living upon and attached to naturally occurring hard or rocky formations with rough, broken, or smooth topography; and areas where a hard substrate and vertical relief may favor the accumulation of turtles, fishes, or other fauna. The Live Bottom (Low Relief) Stipulation OCS blocks are located in water depths of 100 m (328 ft) or less in the EPA and 142 OCS blocks in the northeastern CPA, including Pensacola Blocks 751-754, 793-798, 837-842, 881-886, 925-930, and 969-975; and Destin Dome Blocks 1-7, 45-51, 89-96, 133-140, 177-184, 221-228, 265-273, 309-317, 353-361, 397-405, 441-448, 485-491, 529-534, and 573-576 (refer to **Figure F.9-1**). Within the Live Bottom (Low Relief) Stipulation Blocks, no bottom-disturbing activities may occur within 30 m (100 ft) of any live bottom (low-relief) feature. A bottom survey report showing live bottom location and proposed bottom-disturbing activity will be required as part of any permit application to ensure that sensitive seafloor features are avoided. While the Live Bottom (Low Relief) Stipulation blocks described here are located in areas currently under Presidential withdrawal, they could be subject to this stipulation if the Presidential withdrawal expired, and they were leased in the future.

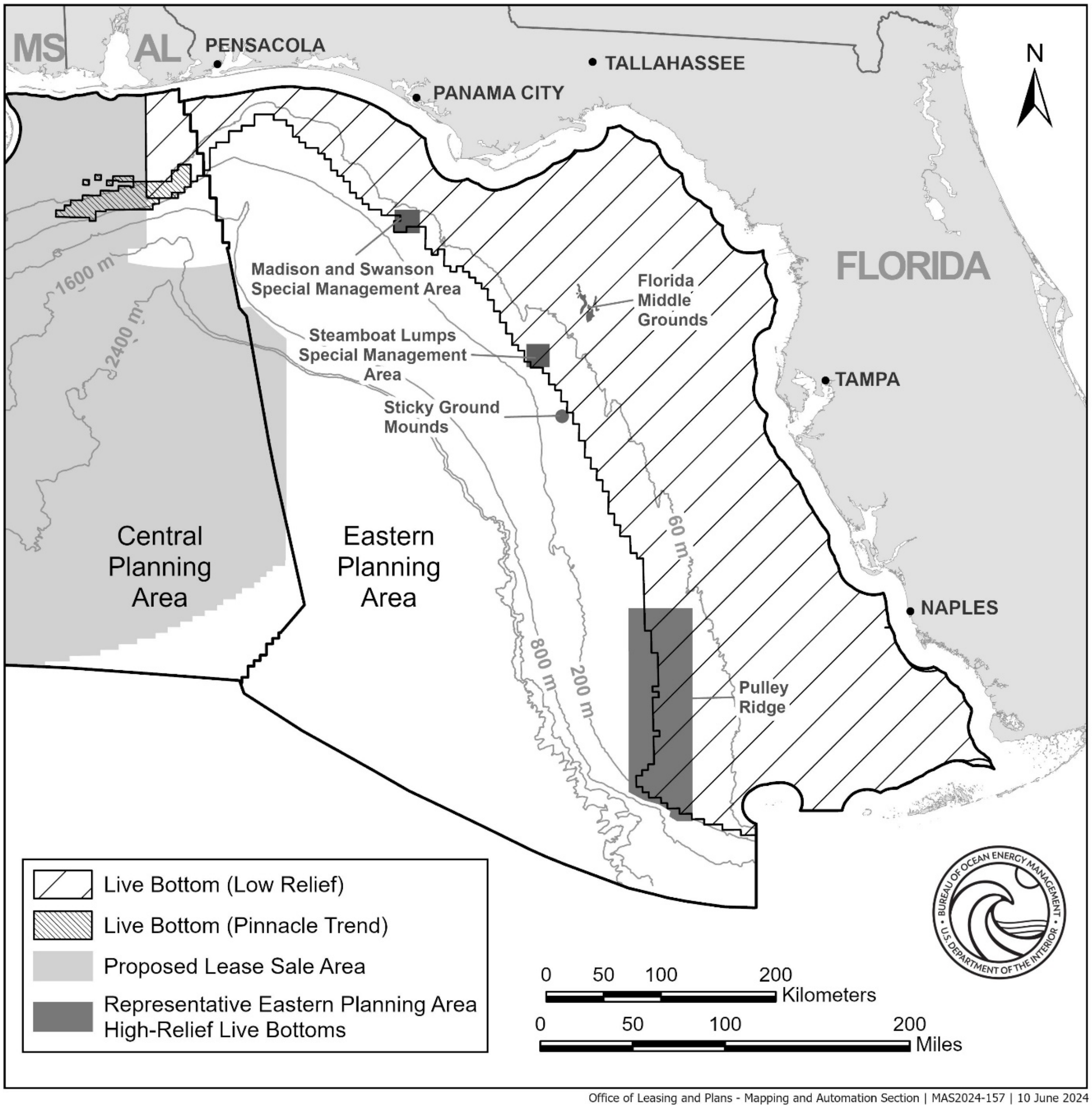

Figure F.9-1. Live Bottom (Low Relief) Stipulation Blocks in the EPA and CPA.

The PSBFs are those features not protected by a biological lease stipulation that are of moderate to high relief (8 ft [2 m] or higher), provide surface area for the growth of sessile invertebrates, and attract large numbers of fish. These features are located outside any No Activity Zone of any of the named topographic features or the 74 live bottom (pinnacle trend) stipulated blocks.

Because PSBFs occur throughout the GOM, they are not protected through lease stipulations that apply to specific OCS blocks, but rather are protected by conditions of approval attached to permits following a site-specific review of a permit application. No bottom-disturbing activities may occur within 30 m (100 ft) of any PSBF. A bottom survey report showing PSBF location and proposed bottom-disturbing activity will be required as part of any permit application to ensure that sensitive seafloor features are avoided.

The potential stipulation language outlined below is only for the Live Bottom (Pinnacle Trend) Stipulation, which is applied as programmatic mitigation in the 2024-2029 National OCS Oil and Gas Program Programmatic EIS (BOEM 2023a) and Record of Decision (BOEM 2023b), and would apply to all leases issued for GOM lease sales under the 2024-2029 National OCS Oil and Gas Program in designated lease blocks. This stipulation is the only Live Bottom Stipulation that has been applied to OCS oil and gas leases recently because the live bottom, low-relief blocks in the EPA and CPA are currently under Presidential withdrawal. Should the Presidential withdrawal end, stipulation language will be included for the live bottom (low relief) OCS blocks. In addition, because there are no lease stipulations for PSBFs, their protection will be handled at the post-lease, site-specific review stage, and conditions of approval will be added to permits to prevent any potential damage to those features.

F.9.2 Potential Stipulation Language

The proposed stipulation reads as follows:

A. For the purpose of this stipulation, “live bottom areas” are defined as seagrass communities or those areas that contain biological assemblages consisting of sessile invertebrates such as sea fans, sea whips, hydroids, anemones, ascidians, sponges, bryozoans, or corals living upon and attached to naturally occurring hard or rocky formations with rough, broken, or smooth topography; or areas whose lithotope favors the accumulation of turtles, fish, and other fauna. Live bottom features may include Pinnacle Trend features, low-relief features, or potentially sensitive biological features.

B. Prior to any drilling activities or the construction or placement of any structure for exploration or development on this lease, including but not limited to, anchoring, well drilling and pipeline and platform placement, the lessee will submit to the Bureau of Ocean Energy Management (BOEM) Gulf of Mexico Regional Director (RD) a live bottom survey report containing a bathymetry map prepared using remote-sensing techniques. The bathymetry map shall be prepared to determine the presence or absence of live bottoms that could be impacted by the proposed activity. This map must encompass the area of the seafloor where surface-disturbing activities, including anchoring, may occur.

C. If it is determined that the live bottoms might be adversely impacted by the proposed activity, the BOEM Gulf of Mexico RD will require the lessee to undertake any measure deemed economically, environmentally, and technically feasible to protect the live bottom areas. These measures may include, but are not limited to, relocation of operations and monitoring to assess the impact of the activity on the live bottom areas.

F.9.3 Effectiveness of the Lease Stipulation

The sessile and pelagic communities associated with the crest and flanks of the live bottom features could be adversely impacted by OCS oil- and gas-related activities if such activities took place on or near these communities without the Live Bottom Stipulation. Impacts from mechanical damage, including anchors, could potentially be long term if the physical integrity of the live bottoms themselves became altered. By identifying the live bottom features present at the activity site, the lessee may be directed to avoid placement of the drilling rig and anchors on the sensitive areas. Through detection and avoidance, this stipulation would minimize the likelihood of mechanical damage from OCS oil- and gas-related activities associated with rig and anchor emplacement to the sessile and pelagic communities associated with the crest and flanks of such features.

For many years, the live bottom stipulations have been made a part of leases on blocks in the CPA and EPA (prior to moratoria and subsequent Presidential withdrawal) to ensure that potential damage to pinnacle trend areas and low-relief features from nearby OCS oil- and gas-related activities are substantially mitigated. The stipulation, which is applied as programmatic mitigation in the 2024-2029 National OCS Oil and Gas Program Programmatic EIS (BOEM 2023a) and Record of Decision (BOEM 2023b), would apply to all leases issued for GOM lease sales under the 2024-2029 National OCS Oil and Gas Program in designated lease blocks and will continue to protect the biota of live bottom areas by substantially mitigating OCS oil- and gas-related activities. This stipulation does not prevent the recovery of oil and gas resources; however, it does serve to protect valuable and sensitive biological resources. Studies at the Pinnacle Trend have shown that the Live Bottom (Pinnacle Trend) Stipulation has successfully prevented mechanical damage to the pinnacle habitats through the survey and distancing requirements, and sediments have not shown elevated barium levels from OCS oil- and gas-related activities within 25 km (15 mi) of the area (Continental Shelf Associates Inc. and Texas A&M University Geochemical and Environmental Research Group 2001).

F.10 STIPULATION NO. 9 – BLOCKS SOUTH OF BALDWIN COUNTY, ALABAMA

F.10.1 Stipulation Overview

This stipulation could be included in leases on blocks south of and within 15 mi (24 km) of Baldwin County, Alabama (**Figure F.6-2**). The stipulation would specify requirements for consultation that lessees must follow when developing plans for fixed structures, with the goal of reducing potential visual impacts.

F.10.2 Potential Stipulation Language

The proposed stipulation reads as follows:

A. To minimize visual impacts from development operations on this block, the lessee will contact lessees and operators of leases in the vicinity prior to submitting a

Development Operations Coordination Document (DOCD) to determine if existing or planned surface production structures can be shared. If feasible, the lessee's DOCD should reflect the results of any resulting sharing agreement, propose the use of subsea technologies, or propose another development scenario that does not involve new surface structures.

B. If the lessee cannot formulate a feasible development scenario that does not call for new surface structure(s), the lessee's DOCD should ensure that they are the minimum distance necessary for the proper development of the block and that they will be constructed and placed using orientation, camouflage, or other design measures in such a manner as to limit their visibility from shore.

C. The Bureau of Ocean Energy Management (BOEM) will review and make decisions on the lessee's DOCD in accordance with applicable Federal regulations and BOEM assessments, and in consultation with the State of Alabama (Geological Survey/Oil and Gas Board).

F.10.3 Effectiveness of the Lease Stipulation

For several years, the then-Governor of Alabama had indicated opposition to new leasing south and within 15 mi (24 km) of Baldwin County but requested that, if the area is offered for lease, a lease stipulation to reduce the potential for visual impacts should be applied to all new leases in this area. Prior to the decision in 1999 on the Final Notice of Sale for Lease Sale 172, BOEM's New Orleans Office's Regional Director, in consultation with the Geological Survey of Alabama/State Oil and Gas Board, developed a lease stipulation to be applied to any new leases within the 15-mi (24-km) area to mitigate potential visual impacts. The stipulation specifies requirements for consultation that lessees must follow when developing plans for fixed structures. A lessee's DOCD should reflect the results of any resulting sharing agreement, should propose the use of subsea technologies, or should propose another development scenario that does not involve new surface structures. If the lessee cannot formulate a feasible development scenario that does not call for new surface structure(s), the lessee's DOCD should ensure that the structures are the minimum necessary for the proper development of the block and that they will be constructed and placed, using orientation, camouflage, or other design measures, in such a manner as to limit their visibility from shore. The stipulation has been continually adopted in annual CPA lease sales and regionwide lease sales since 1999 and substantially mitigates visual impacts.

F.11 Stipulation No. 10 – Restrictions due to Rights-of-Use and Easements for Floating Production Facilities

F.11.1 Stipulation Overview

This proposed stipulation is intended to be lease sale-specific language and would incorporate maps for each potentially affected block containing rights-of-use and easements (refer to **Figure F.11-1** for an example map). This stipulation is designed to minimize or avoid potential space-use conflicts with moored and/or floating production facilities that have already been granted rights-of-use and easements in particular OCS blocks.

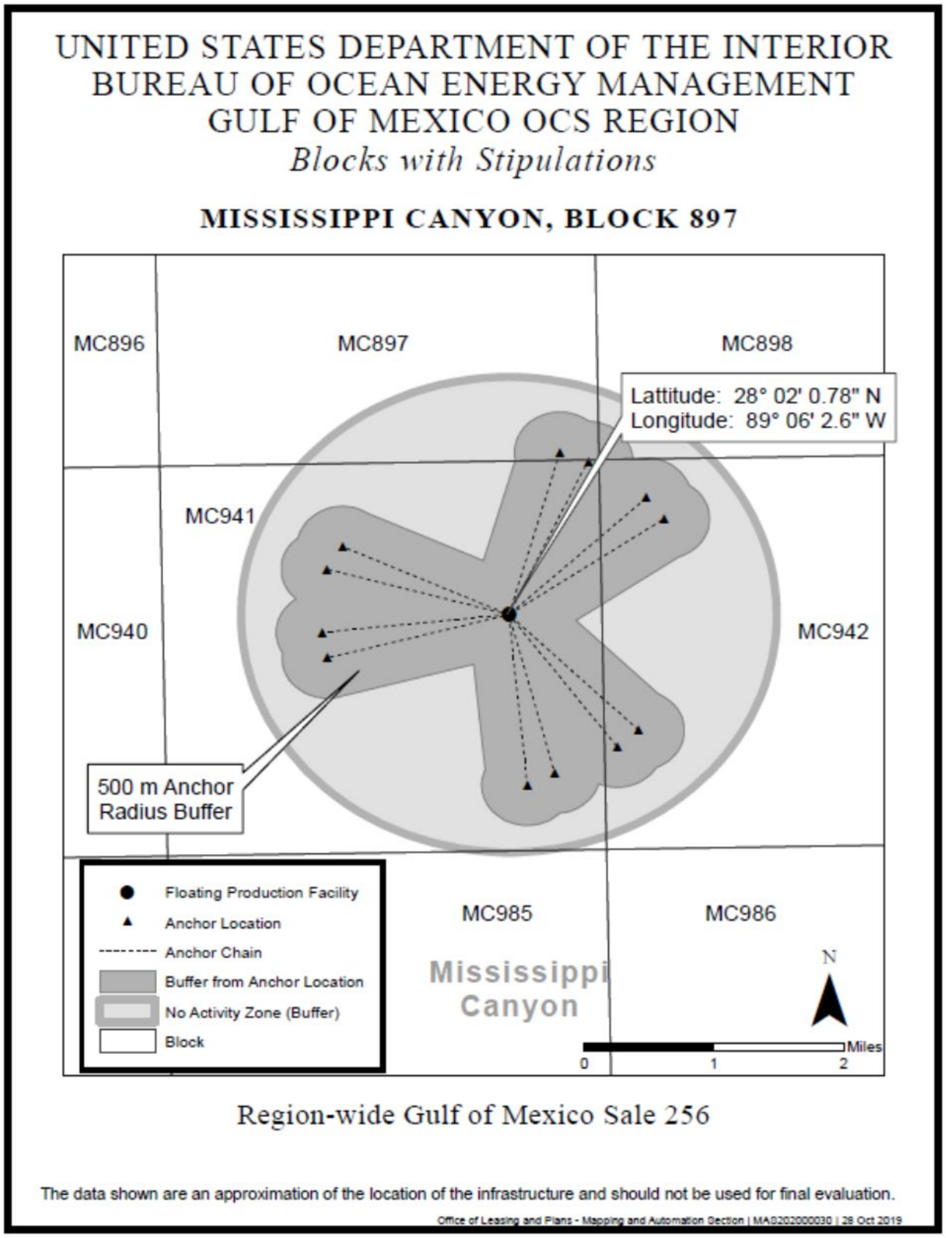

Figure F.11-1. Example Map of a Block Subject to This Stipulation under Regionwide Gulf of Mexico Lease Sale 256 (complete Notice of Sale package can be found on BOEM's website at https://www.boem.gov/sale-256).

F.11.2 Proposed Stipulation Language

The proposed stipulation reads as follows:

The lessee may not conduct activities, including, but not limited to, the construction and use of structures, operation of drilling rigs, laying of pipelines, and/or anchoring on the seafloor or in the water column within the areas depicted by the attached map(s). Nevertheless, sub-seabed activities that are part of exploration, development, and production activities from outside the areas depicted on the attached maps may be allowed within the areas depicted by the attached map(s), including the use of directional drilling or other techniques.

F.11.3 Effectiveness of the Lease Stipulation

This stipulation is designed to minimize or avoid potential space-use conflicts with moored and/or floating production facilities that have already been granted rights-of use and easements in particular OCS blocks. BOEM has effectively used this stipulation for over a decade to make bidders aware of other activities with rights-of-use and easements on the blocks offered for OCS oil and gas leasing, and BOEM may require buffers or additional requirements prior to issuing leases on those specific blocks.

F.12 Stipulation No. 11 – Royalties on All Produced Gas

F.12.1 Stipulation Overview

This stipulation may be included in all leases issued as a result of an OCS oil and gas lease sale.

F.12.2 Potential Stipulation Language

The proposed stipulation reads as follows:

Pursuant to Section 50263 of the Inflation Reduction Act of 2022 Public Law 117-169, 136 Statute 1818 (2022), royalties must be assessed and paid accordingly by the lessee(s)/operator(s) on all gas produced under this lease, including all gas that is consumed or lost by venting, flaring, or negligent releases through any equipment during upstream operations. The lessee(s)/operator(s) must value any gas or liquid hydrocarbons, including that consumed or lost by venting, flaring, or negligent releases, in accordance with the provisions of 30 CFR part 1206.

This royalty will not apply with respect to:

(1) gas vented or flared for not longer than 48 hours in an emergency situation that poses a danger to human health, safety, or the environment;
(2) gas used or consumed within the area of the lease, unit, or communitized area for the benefit of the lease, unit, or communitized area; or
(3) gas that is unavoidably lost.

For any gas that the lessee(s)/operator(s) produces, but for which the lessee(s)/operator(s) does not pay royalties, the lessee(s)/operator(s) bear the burden of proof in demonstrating to the satisfaction of BOEM and the Office of Natural Resource Revenues that one or more of these exceptions to the requirement to pay royalties under this stipulation applies.

F.12.3 Effectiveness of the Lease Stipulation

Pursuant to Section 50263 of the Inflation Reduction Act of 2022, Public Law 117-169, 136 Statute 1818 (2022), royalties must be assessed and paid accordingly by the lessee(s)/operator(s) on all gas produced under this lease, including all gas that is consumed or lost by venting, flaring, or negligent releases through any equipment during upstream operations. The lessee(s)/operator(s) must value any gas or liquid hydrocarbons, including that consumed or lost by venting, flaring, or negligent releases, in accordance with the provisions of 30 CFR part 1206.

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APPENDIX G

STATE COASTAL MANAGEMENT PROGRAMS

G STATE COASTAL MANAGEMENT PROGRAMS

Each State's Coastal Management Program (CMP), federally approved by the National Oceanic and Atmospheric Administration (NOAA), is a comprehensive statement setting forth objectives, enforceable policies or guidelines, and standards for public and private use of land and water resources and uses in that State's coastal zone. The program provides for direct State land and water use planning and regulations. The plan also includes a definition of what constitutes permissible land uses and water uses. Federal consistency is the Coastal Zone Management Act (CZMA) requirement where Federal agency activities that have reasonably foreseeable effects on any land or water use or natural resource of the coastal zone must be consistent to the maximum extent practicable with the enforceable policies or guidelines of a coastal state's federally approved coastal management program. The latest Federal consistency regulations concerning State coastal zone management (CZM) programs are found in the *Federal Register* (65 FR 77124 and 71 FR 788).

Each Gulf States' official coastal boundary can be identified from NOAA's website at https://coast.noaa.gov/data/czm/media/StateCZBoundaries.pdf. Once a State's CMP is federally approved, Federal agencies must ensure that their actions are consistent to the maximum extent practicable with the enforceable polices of the approved program. Federal agencies provide feedback to the States through each Section 312 evaluation conducted by NOAA.

To ensure conformance with State CMP policies or guidelines and local land use plans, the Bureau of Ocean Management (BOEM) prepares a Federal consistency determination for each proposed Outer Continental Shelf (OCS) lease sale. Through the designated State CZM agency, local land use entities are provided numerous opportunities to comment on the OCS Program. Local land-use agencies also have the opportunity to comment directly to BOEM at any time, as well as during formal public comment periods related to the announcement of the Five-Year Program, Call for Information/Notice of Intent, environmental impact statement (EIS) scoping, public hearings on the Draft EIS, and the Proposed Notice of Sale.

A State's approved CMP may also provide for the State's review of OCS plans, permits, and license activities to determine whether they will be conducted in a manner consistent with the State's CMP. This review authority is applicable to activities conducted in any area that has been leased under the OCS Lands Act (OCSLA) and that affect any land or water use or natural resource within the State's coastal zone (16 U.S.C. § 1456(c)(3)(B)).

State of Texas Coastal Management Program

The Texas Coastal Management Program (TCMP) Final EIS was published in August 1996. On December 23, 1996, NOAA approved the TCMP, and the requirements therein were made operational as of January 10, 1997. The TCMP is based primarily on the Coastal Coordination Act (CCA) of 1991 (33 Tex. Nat. Res. Code Ann. Ch. 201 *et seq.*), as amended by House Bill 3226 (1995), which calls for the development of a comprehensive coastal program based on existing statutes and regulations. The CCA established the geographic scope of the program by identifying the program's inland, interstate, and seaward boundaries. The program's seaward boundary is the State's territorial seaward limit (3 leagues or 10.36 miles or 16.67 kilometers). The State's inland boundary is based on the State's Coastal Facilities Designation Line (CFDL). The CFDL was developed in response to the Oil Pollution Act of 1990 and basically delineates those areas within which oil spills could affect coastal waters or resources. For the purposes of the TCMP, the CFDL has been modified to capture wetlands in upper reaches of tidal waters. The geographic scope also extends upstream 200 miles (322 kilometers) from the mouths of rivers draining into coastal bays and estuaries in order to manage water appropriations on those rivers. The program's boundaries encompass all or portions of 18 coastal counties (including Cameron, Willacy, Kenedy, Kleberg, Nueces, San Patricio, Aransas, Refugio, Calhoun, Victoria, Jackson, Matagorda, Brazoria, Galveston, Harris, Chambers, Jefferson, and Orange Counties), roughly 8.9 million acres (3.6 million hectares) of land and water.

Within this coastal zone boundary, the scope of the TCMP's regulatory program is focused on the direct management of 16 generic "Areas of Particular Concern," called coastal natural resource areas (CNRAs). These CNRAs are associated with valuable coastal resources or vulnerable or unique coastal areas and include the following: waters of the open Gulf of Mexico (GOM); waters under tidal influence; submerged lands; coastal wetlands; seagrasses; tidal sand and mud flats; oyster reefs; hard substrate reefs; coastal barriers; coastal shore areas; GOM beaches; critical dune areas; special hazard areas; critical erosion areas; coastal historic areas; and coastal preserves.

The State has designated the Western Planning Area (WPA) as the geographical area in which Federal consistency shall apply outside of the coastal boundary. The TCMP also identifies Federal lands excluded from the State's coastal zone, such as U.S. Department of Defense facilities and wildlife refuges.

Land and water uses subject to the program generally include the siting, construction, and maintenance of electric generating and transmission facilities; oil and gas exploration and production; and the siting, construction, and maintenance of residential, commercial, and industrial development on beaches, critical dune areas, shorelines, and within or adjacent to critical areas and other CNRAs. Associated activities also subject to the program include canal dredging; filling; placement of structures for shoreline access and shoreline protection; on-site sewage disposal, storm-water control, and waste management for local governments and municipalities; the siting, construction, and maintenance of public buildings and public works such as dams, reservoirs, and flood control projects and associated activities; the siting, construction, and maintenance of roads, highways, bridges, causeways, airports, railroads, and nonenergy transmission lines and associated activities; certain agricultural and silvicultural activities; water impoundments and diversions; and the siting, construction, and maintenance of marinas, State-owned fishing cabins, artificial reefs, public recreational facilities, structures for shoreline access and shoreline protection, boat ramps, and fishery management measures in the GOM.

The TCMP is a networked program that is implemented primarily through 8 State agencies, 18 local governments, and the Coastal Coordination Advisory Committee (Committee). The program relies primarily on direct State control of land and water uses, although local governments will implement State guidelines related to beach and dune management. Implementation and enforcement of the coastal policies is primarily the responsibility of the networked agencies and local governments through their existing statutes, regulatory programs, or other authorizations. Networked agencies include the General Land Office/School Land Board, Texas Commission on Environmental Quality, Railroad Commission of Texas, Texas Parks and Wildlife Commission, Texas Department of Transportation, Texas Water Development Board, Texas State Soil and Water Conservation Board, and the Texas Sea Grant College Program at Texas A&M University. Other members on the Council include four gubernatorial appointees: (1) a coastal business representative; (2) an agriculture representative; (3) a local elected official; and (4) a coastal citizen. Similarly, 18 county and municipal governments, in those counties with barrier islands, are also networked entities with responsibilities for program implementation vis-a-vis beaches and dunes.

Regulations, programs, and expertise of State, Federal, and local government entities are linked to the management of Texas CNRAs in the TCMP. Local governments are notified of relevant TCMP decisions, including those that may conflict with local land-use plans or zoning ordinances. The Committee includes a local government representative as a full-voting member. An additional local government representative can be added to the Committee as a non-voting member for special local matters under review. The Committee established a permanent advisory committee to ensure effective communication for local governments with land-use authority.

In 1994, this Agency entered into a Memorandum of Understanding (MOU) with the Texas General Land Office to address similar mineral resource management responsibilities between the two entities and to encourage cooperative efforts and promote consistent regulatory practices. This MOU, which encompasses a broad range of issues and processes, outlines the responsibilities and cooperative efforts, including leasing and CZMA review processes, agreed to by the respective agencies. Effective January 10, 1997, all operators were required to submit to BOEM certificates of consistency with the TCMP for proposed operations in the WPA.

This Agency developed coordination procedures with the State for submittal of offshore lease sale consistency determinations and plans of operation. The WPA Lease Sale 168 was this Agency's first Federal action subject to State consistency review. This Agency and the State of Texas revised CZM consistency information for OCS plans, permits, and licenses to conform to the revised CZM regulations that were effective January 8, 2001, and updated on January 5, 2006, and have also incorporated streamlining improvements into the latest Notices to Lessees and Operators (NTLs) (NTLs 2008-G04, 2009-G27, and 2015-BOEM-N01). The State of Texas requires an adequate description, objective, and schedule for the project; site-specific information on the onshore support base, support vessels, shallow hazards, oil-spill response, wastes and discharges, transportation activities, and air emissions; and a Federal consistency certification, assessment, and findings. The State's requirements for Federal consistency review are based specifically on U.S. Department of the Interior's (DOI's) regulations at 30 CFR parts 250, 254, 256, and 550, and NOAA's Federal consistency regulations at 15 CFR part 930. This Agency will be continuing a dialogue with the State of Texas on reasonably foreseeable coastal effects for pipelines and other permits, and the result of these discussions will be incorporated into future updates of this Agency's NTLs and/permitting procedures.

State of Louisiana, Office of Coastal Management

The statutory authority for Louisiana's coastal zone management program, the Louisiana Office of Coastal Management (LOCM), is the State and Local Coastal Resources Management Act of 1978 *et seq*. (Louisiana Administrative Code, Volume 17, Title 43, Chapter 7, Coastal Management, June 1990 revised). The State statute puts into effect a set of State coastal policies and coastal use guidelines that apply to coastal land and water use decisionmaking. A number of existing State regulations are also incorporated into the program, including those concerning oil and gas and other mineral operations; leasing of State lands for mineral operations and other purposes; hazardous waste and radioactive materials; management of wildlife, fish, other aquatic life, and oyster beds; endangered species; air and water quality; and the Louisiana Superport.

The State statute also authorized establishment of Special Management Areas. Included as Special Management Areas are the Louisiana Offshore Oil Port (LOOP) and the Marsh Island Wildlife Refuge. For purposes of the CZMA, only that portion of LOOP within Louisiana's coastal zone is part of the Special Management Area. In April 1989, the Louisiana Legislature created the Wetlands Conservation and Restoration Authority and established a Wetlands Conservation and Restoration Trust Fund to underwrite restoration projects. The Legislature also reorganized part of the Louisiana Department of Natural Resources (LDNR) by creating the Office of Coastal Restoration and Management.

Local governments (parishes) may assume management of uses of local concern by developing a local coastal program consistent with the State CMP. The State of Louisiana has 10 approved local coastal management programs (Calcasieu, Cameron, Jefferson, Lafourche, Orleans, St. Bernard, St. James, Plaquemines, Terrebonne, and St. Tammany Parishes). In addition, two additional parishes, St. John the Baptist and St. Charles, have worked towards developing local coastal management programs. Eight other programs (Assumption, Iberia, Livingston, St. Charles, St. Martin, St. Mary, Tangipahoa, and Vermilion Parishes) have not been formally approved by NOAA. The parish planning and/or permits offices often serve as the permitting agency for projects limited to local concern. Parish-level programs, in addition to issuing permits for uses of local concern, also function as a commenting agency to Louisiana's CZM agency, the LOCM, regarding permitting of uses of State concern.

Appendix C2 of the LOCM outlines the rules and procedures for the State's local CMP. Under the LOCM, parishes are authorized, though not required, to develop local CMPs. Approval of these programs gives parishes greater authority in regulating coastal development projects that entail uses of local concern. Priorities, objectives, and policies or guidelines of local land use plans must be consistent with the policies and objectives of Act 361, the LOCM, and the State guidelines, except for a variance adopted in Section IV.D of Appendix C2 of the LOCM. The Secretaries of LDNR and Wildlife and Fisheries may jointly rule on an inconsistent local program based on local environmental conditions or user practices. State and Federal agencies review parish programs before they are adopted.

The coastal use guidelines are based on seven general policies or guidelines. State concerns that could be relevant to an OCS lease sale and its possible direct effects or associated facilities and nonassociated facilities are (a) any dredge and fill activity that intersects more than one waterbody, (b) projects involving the use of State-owned lands or water bottoms, (c) national interest projects, (d) pipelines, and (e) energy facility siting and development. Some coastal activities of concern that could be relevant to a lease sale include wetland loss due to channel erosion from OCS traffic; activities near reefs and topographic highs; activities that might affect endangered, threatened, or commercially valuable wildlife; and potential socioeconomic impacts due to offshore development. Secondary and cumulative impacts to coastal resources such as onshore facility development, cumulative impacts from infrastructure development, salt intrusion along navigation channels, etc. are also of particular concern.

Effective August 1993, the LOCM required that any entity applying for permits to conduct activities along the coast must notify the landowner of the proposed activity. An affidavit must also accompany any permit application. Through this regulation, the State strives to minimize coastal zone conflicts.

This Agency and the State of Louisiana revised CZM consistency information for OCS plans, permits, and licenses to conform to the revised CZM regulations that were effective January 8, 2001, and updated on January 5, 2006, and have also incorporated streamlining improvements into the latest NTLs (NTLs 2008-G04, 2009-G27, and 2015-BOEM-N01). Federal consistency for right-of-way (ROW) pipelines is addressed in NTL 2007-G20. The State of Louisiana requires an adequate description, objective, and schedule for the project. Also, the State requires site-specific information on the onshore support base, support vessels, shallow hazards, oil-spill response, wastes and discharges (including any disposal of wastes within the State coastal zone and waters and municipal, parish, or State facilities to be used), transportation activities, air emissions, and secondary and cumulative impacts; and a Federal consistency certification, assessment, and findings. In addition, the State receives consistency reviews on a case-by-case basis for decommissioning activities within OCS Significant Sediment Blocks that the State utilizes marine mineral resources for restoration projects. The State requirements for Federal consistency review are based specifically on DOI's regulations at 30 CFR parts 250, 254, 256, and 550, and NOAA's Federal consistency regulations at 15 CFR part 930. BOEM is continuing a dialogue with the State of Louisiana on reasonably foreseeable coastal effects associated with pipelines and other permits, and the result of these discussions will be incorporated into future updates of the Bureau of Ocean Energy Management's NTLs and/or permitting procedures.

State of Mississippi Coastal Program

The Mississippi Coastal Program (MCP) is administered by the Mississippi Department of Marine Resources. The MCP is built around several enforceable goals that promote comprehensive management of coastal resources and encourage a balance between environmental protection/ preservation and development in the coastal zone. The primary coastal management statute is the Coastal Wetlands Protection Law. Other major features of the MCP include statutes related to fisheries, air and water pollution control, surface and groundwater, cultural resources, and the disposal of solid waste in marine waters. The Department of Marine Resources, the Department of Environmental Quality, and the Department of Archives and History are identified collectively as the "coastal program agencies." Mississippi manages coastal resources by regulation and by promoting activities that use resources in compliance with the MCP. The State developed a coastal wetlands use plan, which includes designated use districts in coastal wetlands and Special Management Area Plans that steer development away from fragile coastal resources and help to resolve user conflicts.

For the purposes of the coastal program, the coastal zone encompasses the three coastal counties of Hancock, Harrison, and Jackson and all coastal waters. The Mississippi coast has 359 miles (594 kilometers) of shoreline, including the coastlines of offshore barrier islands (Cat, Ship, Horn, and Petit Bois Islands). According to NOAA, there are no approved local CMPs for the State of Mississippi. The Southern Mississippi Planning and Development District serves in an advisory capacity to the State coastal agencies.

This Agency developed coordination procedures with the State for submittal of offshore lease sale consistency determinations and plans of operation. This Agency and the State of Mississippi revised CZM consistency information for OCS plans, permits and licenses to conform to the revised CZM regulations that were effective January 8, 2001, and updated on January 5, 2006, and have also incorporated streamlining improvements into the latest NTLs (NTLs 2008-G04, 2009-G27, and 2015-BOEM-N01). Federal consistency for ROW pipelines is addressed in NTL 2007-G20. The State of Mississippi requires an adequate description, objective, and schedule for the project; site-specific information on the onshore support base, support vessels, shallow hazards, oil-spill response, wastes and discharges, transportation activities, and air emissions; and a Federal consistency certification, assessment, and findings. The State requirements for Federal consistency review are based specifically on DOI's regulations at 30 CFR parts 250, 254, 256, and 550, and NOAA's Federal consistency requirements at 15 CFR part 930. BOEM is continuing a dialogue with the State of Mississippi on reasonably foreseeable coastal effects associated with pipelines and other permits, and the result of these discussions will be incorporated into future updates of the Bureau of Ocean Energy Management's NTLs and/or permitting procedures.

State of Alabama Coastal Area Management Program

The Alabama Coastal Area Act (ACAA) provides statutory authority to review all coastal resource uses and activities that have a direct and significant effect on the coastal area. The Alabama Department of Conservation and Natural Resources (ADCNR) Lands Division, Coastal Section Office, the lead coastal management agency, is responsible for the management of the State's coastal resources through the Alabama Coastal Area Management Program (ACAMP). The ADCNR is responsible for the overall management of the program, including fiscal and grants management and public education and information. The department also provides planning and technical assistance to local governments and financial assistance to research facilities and units of local government when appropriate. The State Lands Division, Coastal Section, also has authority over submerged lands in regard to piers, marinas, bulkheads, and submerged land leases.

The Alabama Department of Environmental Management (ADEM) is responsible for coastal area permitting, regulatory, and enforcement functions. Most programs of ADCNR Coastal Section that require environmental permits or enforcement functions are carried out by the ADEM with the exception of submerged land issues. The ADEM has the responsibility of all permit, enforcement, regulatory, and monitoring activities, and the adoption of rules and regulations to carry out the ACAMP. The ADEM must identify specific uses or activities that require a State permit to be consistent with the coastal policies noted above and the more detailed rules and regulations promulgated as part of the ACAMP. Under the ACAA, State agency activities must be consistent with ACAMP policies and ADEM findings. Further, ADEM must make a direct permit-type review for uses that are not otherwise regulated at the State level. The ADEM also has authority to review local government actions and to assure that local governments do not unreasonably restrict or exclude uses of regional benefit. Ports and major energy facilities are designated as uses of regional benefit. The ADCNR Lands Division manages all lease sales of State submerged bottomlands and regulates structures placed on State submerged bottomlands.

Local governments have the option to participate in the ACAMP by developing local codes, regulations, rules, ordinances, plans, maps, or any other device used to issue permits or licenses. If these instruments are certified to be consistent with ACAMP, ADEM may allow the local government to administer them by delegating its permit authority, thereby eliminating the need for ADEM's case-by-case review.

The South Alabama Regional Planning Commission provides ongoing technical assistance to ADCNR for Federal consistency, clearinghouse review, and public participation procedures. Uses subject to the Alabama's CZM program are divided into regulated and nonregulated categories. Regulated uses are those that have a direct and significant impact on the coastal areas. These uses either require a State permit or are required by Federal law to be consistent with the management program. Uses that require a State permit must receive a certificate of compliance. Nonregulated uses are those activities that have a direct and significant impact on the coastal areas that do not require a State permit or Federal consistency certification. Nonregulated uses must be consistent with ACAMP and require local permits to be administered by ADEM.

This Agency developed coordination procedures with the State for submittal of offshore lease sale consistency determinations and plans of operation. This Agency and the State of Alabama have revised CZM consistency information for OCS plans, permits, and licenses to conform to the revised CZM regulations that were effective January 8, 2001, and updated on January 5, 2006, and have also incorporated streamlining improvements into the latest NTLs (NTLs 2008-G04, 2009-G27, and 2015-BOEM-N01). Federal consistency for ROW pipelines is addressed in NTL 2007-G20. The State of Alabama requires an adequate description, objective, and schedule for the project; site-specific information on the onshore support base, support vessels, shallow hazards, oil-spill response, wastes and discharges, transportation activities, and air emissions; and a Federal consistency certification, assessment, and findings. The State's requirements for Federal consistency review are based specifically on DOI's regulations at 30 CFR parts 250, 254, 256, and 550, and NOAA's Federal consistency requirements at 15 CFR part 930. BOEM is continuing a dialogue with the State of

Alabama on reasonably foreseeable coastal effects associated with pipelines and other permits, and the result of these discussions will be incorporated into future updates of Bureau of Ocean Energy Management's NTLs and/or permitting procedures.

State of Florida Coastal Management Program

For purposes of the CZMA, the State of Florida's coastal zone includes the area encompassed by the State's 67 counties and its territorial seas. Lands owned by the Federal Government and the Seminole and Miccosukee Indian tribes are not included in the State's coastal zone; however, Federal activities in or outside the coastal zone, including those on Federal or Tribal lands, that affect any land or water or natural resource of the State's coastal zone are subject to review by Florida under the CZMA. The Florida Coastal Management Act, codified as Chapter 380, Part II, Florida Statutes, authorized the development of a coastal management program. In 1981, the Florida Coastal Management Program (FCMP) was approved by NOAA.

The policies identified by the State of Florida as being enforceable in the FCMP are the 24 chapters that NOAA approved for incorporation in the State's program. The 2011 Florida Statutes are the most recent version approved by NOAA and include the listing of OCSLA permits under Subpart E and the addition of draft EAs and EISs as necessary data and information for Federal consistency review

A network of eight State agencies and five regional water management districts implement the FCMP's 24 statutes. The water management districts are responsible for water quantity and quality throughout the State's watersheds. The State agencies include the following: the Department of Environmental Protection (DEP), the lead agency for the FCMP and the State's chief environmental regulatory agency and steward of its natural resources; the Department of Community Affairs, which serves as the State's land planning and emergency management agency; the Department of Health, which, among other responsibilities, regulates on-site sewage disposal; the Department of State, Division of Historical Resources, which protects historic and archaeological resources; the Fish and Wildlife Conservation Commission, which protects and regulates fresh and saltwater fisheries, marine mammals, and birds and upland species, including protected species and the habitat used by these species; the Department of Transportation, which is charged with the development, maintenance, and protection of the transportation system; the Department of Agriculture and Consumer Services, which manages State forests and administers aquaculture and mosquito control programs; and the Governor's Office of Planning and Budget, which plays a role in the comprehensive planning process.

Effective July 1, 2000, the Governor of Florida assigned the State's responsibilities under the OCSLA to the Secretary of the Florida DEP. The DEP's Office of Intergovernmental Programs coordinates the review of OCS plans with FCMP member agencies to ensure that the plan is consistent with applicable State enforceable policies and the Governor's responsibilities under the Act.

This Agency developed coordination procedures with the State for the submittal of offshore lease sale consistency determinations and plans of operation. In 2003, this Agency and the State revised CZM consistency information for OCS plans, permits, and licenses to conform with the revised CZM regulations that were effective on January 8, 2001, and updated on January 5, 2006, and they have also incorporated streamlining improvements into the latest NTLs (NTLs 2008-G04, 2009-G27, and 2015-BOEM-N01). Federal consistency for ROW pipelines is addressed in NTL 2007-G20.

The State of Florida requires an adequate description, objective, and schedule for all activities associated with a project; specific information on the natural resources potentially affected by the proposed activities; and specific information on onshore support base, support vessels, shallow hazards, oil-spill response, wastes and discharges, transportation activities, and air emissions; and a Federal consistency certification, assessment, and findings. As identified by the State of Florida, the State enforceable policies that must be addressed for OCS oil- and gas-related activities are found at http://www.boem.gov/CZM-Program-Policies-for-GOM-States.aspx. These requirements have been incorporated into the Plans and Regional Oil-Spill Response NTLs. The State requirements for Federal consistency review are based on the requirements of State statutes, CZMA regulations at 15 CFR part 930, and DOI's regulations at 30 CFR parts 250, 254, 256, and 550. BOEM is continuing a dialog with the State of Florida on reasonably foreseeable coastal effects associated with OCS plans, pipelines, and other permits; the result of these discussions will be incorporated into future updates of the Bureau of Ocean Energy Management's NTLs and/or permitting procedures.

APPENDIX H

GULF OF MEXICO OCS OIL AND GAS LEASING GREENHOUSE GAS EMISSIONS AND SOCIAL COSTS ANALYSIS

H GULF OF MEXICO OCS OIL AND GAS LEASING GREENHOUSE GAS EMISSIONS AND SOCIAL COSTS ANALYSIS

H.1 OVERVIEW

This appendix provides additional discussion on the methodology, results, and uncertainty in the Bureau of Ocean Energy Management's (BOEM's) greenhouse gas (GHG) emissions analysis presented in Chapter 4. BOEM estimates GHG emissions and social costs for oil and gas leasing on the Gulf of Mexico (GOM) Outer Continental Shelf (OCS). This analysis encompasses GHG emissions resulting from the full life cycle of potential oil and gas exploration, development, production, and consumption. It also estimates offsetting reductions in GHG emissions under the proposed action due to displacement of energy substitutes from the potential oil and gas production.

BOEM's analysis of GHG life cycle emissions resulting from the proposed action indicates that emissions from OCS oil and natural gas are similar to those resulting from displaced energy substitutes when looking at domestically produced or consumed fuels. This finding stems from the fact that OCS production would replace other energy sources and displace their associated emissions. BOEM also considers the changes in foreign oil production and consumption and associated changes in global emissions in response to the proposed action (i.e., a single proposed OCS oil and gas lease sale in the GOM). BOEM's analysis finds that global emissions would likely increase under each scenario's activity level for the proposed action (i.e., low, mid-, or high activity level).

Section H.2.3, provides full life cycle GHG emissions from domestically produced or consumed energy under the proposed action separated into upstream emissions (**Table H.2-5**) and the mid- and downstream GHG emissions (**Table H.2-7**). The full life cycle GHG emissions are presented in **Table H.2-8**. BOEM's analysis of emissions from oil and gas produced and consumed outside the U.S. is segmented into a quantitative set of GHG emissions estimates (**Section H.2.5**) and a qualitative discussion of foreign GHG emissions (**Section H.4**). The foreign GHG emissions estimates are discussed quantitatively (**Section H.2.5**) and qualitatively (**Section H.4**).

Anthropogenic emissions of GHGs are the primary contributors to climate change (U.S. Global Change Research Program 2018). BOEM recognizes the global scope of the impacts of GHG emissions and the potential contributions of the effects of agency actions to global GHG concentrations. As such, this appendix provides a detailed methodology of BOEM's life cycle GHG analysis as well as an overview of how OCS oil and gas leasing fits into the context of aggregate emissions, demand, and United States (U.S.) GHG reduction goals.

H.2 LIFE CYCLE GREENHOUSE GAS EMISSIONS

Life cycle refers to emissions from all activities related to the exploration, development, production, and consumption of a resource. For hydrocarbon resources, the activities are often grouped into three stages: upstream, midstream, and downstream (**Figure H.2-1**). Upstream activities include exploration, development, and production, which are described in the exploration and development scenarios (refer to **Section H.3**).[1] Midstream activities are associated with refining, processing, storage, and distribution of fuels produced from leases issued via oil and gas lease sales in the GOM. Finally, downstream activities are associated with the consumption of those fuels.

Figure H.2-1. Life Cycle Stages of Greenhouse Gas Emissions.

The activities associated with each stage would result in GHG emissions, including carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O). These GHG emissions contribute to climate change globally. The analysis below quantifies projected GHG emissions that could occur from new leasing under the proposed action and the subsequent consumption of produced fuels. These projected GHG emissions serve as a proxy for assessing the potential contribution to climate change globally from OCS leasing.

H.2.1 Analysis Framing

To consider the full impact of OCS leasing, BOEM estimates emissions associated with additional OCS oil and natural gas production and emissions reductions associated with potential energy market substitutes displaced by OCS production from new leases. Because additional OCS production would increase supply and lower prices, this production results in an increase in the quantity demanded for oil and natural gas. As consumers switch to consuming more OCS oil and natural gas, they reduce their consumption (demand) of substitute energy sources like coal, biofuel, renewables, and onshore or imported oil and natural gas. Further, due to the reduced demand for energy substitutes, prices for those energy sources would also decline, causing suppliers to reduce

[1] In order to generate estimates of anticipated future oil and gas production, BOEM develops oil and gas exploration and development scenarios under a given leasing schedule. The scenarios describe the development and production activities required to explore for, extract, and transport to market the anticipated oil and gas production.

their production of these substitute energy sources. BOEM's life cycle analysis considers these substitute sources and the emissions that they would generate if not for OCS production.[2] BOEM further discusses the concepts of displacement and substitute energy sources in **Section H.2.2.1** and **Section H.5.1.2**.

Given the global nature of energy, in particular oil, and the GHG emissions resulting from energy production through consumption, the quantitative GHG emissions analysis can be categorized into two components: (1) estimated GHG emissions resulting from domestically produced or consumed fuels; and (2) estimated GHG emissions when considering the shift in foreign oil production and consumption. BOEM can model domestic energy markets with sufficient reliability to estimate the energy substitutes produced or consumed domestically. However, global energy markets cannot be modeled to the same level of detail as the domestic energy sources.

BOEM's greenhouse gas analysis considers a No Action Alternative in which there is no new OCS leasing. Because there is no new leasing in the No Action Alternative, there are no associated GHG emissions assigned to the No Action Alternative as they are considered the baseline level of emissions. OCS oil and gas production and associated GHG emissions from existing leases would still occur in the absence of the proposed action, but because these activities and emissions would occur regardless of future leasing decisions, they are not quantified. They are treated as part of the modeling baseline along with all other sources of energy not directly stemming from a new OCS lease sale. To the extent existing leases' production or other energy sources are displaced by the proposed action's production, BOEM accounts for the emissions reductions within its estimate of the total proposed action emissions. Total proposed action emissions are those associated with OCS exploration, development, and production from a lease sale under the proposed action after accounting for those emissions displaced from substitute energy sources which are not produced or consumed under the proposed action.

BOEM frames energy substitutes in this Programmatic EIS as displacements occurring under the proposed action rather than as substitutions under the No Action Alternative as described in BOEM's previous GHG analysis. This change was made in response to comments received from stakeholders. Specifically, the U.S. Environmental Protection Agency (USEPA) provided comments recommending that, for consistency with the Council on Environmental Quality's National Environmental Policy Act guidelines, BOEM present a No Action Alternative with no emissions

[2] This displacement of substitute sources does not occur on a 1:1 basis (a concept known as "perfect substitution"). The decline in oil and gas prices leads to an increase in overall energy consumption of roughly 10% of the new OCS production modeled by BOEM using the exploration and development scenarios. The remaining 90% of the new OCS production represents displacement of substitute energy sources. BOEM's modeling suggests that the displaced energy sources are primarily oil imports and domestic onshore oil and natural gas.

resulting from the proposed action[3]. As such, this analysis shows GHG emissions associated with the substitute energy sources that are displaced by new OCS oil and gas production as negative values reducing total GHG emissions under the proposed action rather than as positive values increasing GHG emissions under the No Action Alternative. Thus, the total proposed action emissions are the GHG emissions from new OCS production plus the reduction in GHG emissions from displaced energy substitutes. The framing of the analysis here has no impact on the reported GHG emissions associated with the proposed action. BOEM's previous analysis included an estimate of incremental emissions (i.e., Proposed Action emissions less No Action Alternative emissions), whereas this analysis includes an estimate of total proposed action emissions (i.e., proposed action emissions plus displaced energy emissions). BOEM's analysis using the current methodology remains fundamentally the same as the previous methodology, only the framing and presentation of the proposed action GHG emissions has changed (**Figure H.2-2**).

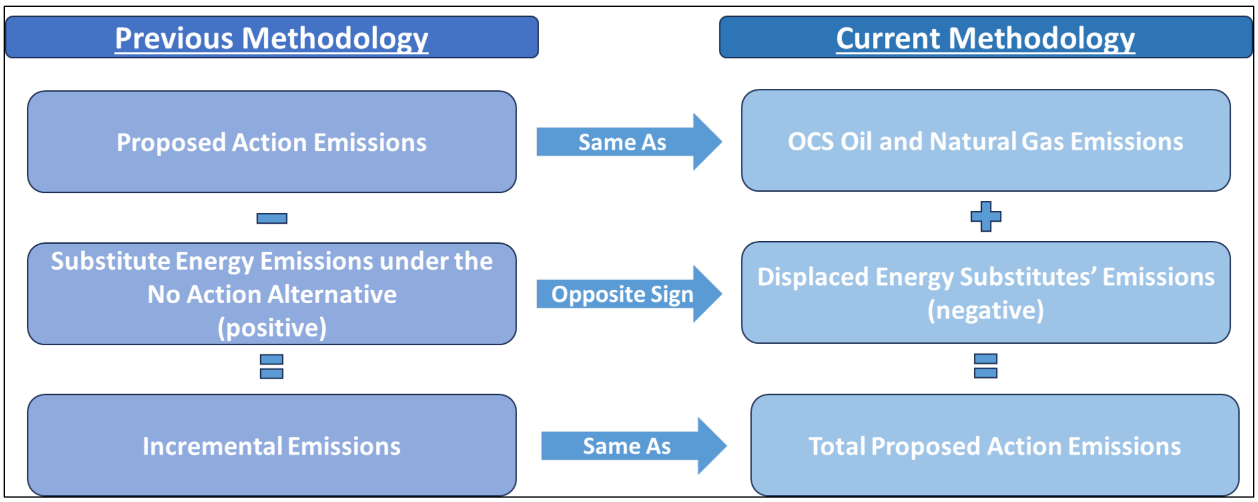

Figure H.2-2. Change to BOEM's Framing of the Proposed Action's Domestically Produced or Consumed GHG Emissions.

Table H.2-1 presents BOEM's overall GHG modeling approach. BOEM quantitatively considers the life cycle GHG emissions associated with domestically produced or consumed energy (**Section H.2.3**). BOEM provides quantitative estimates of GHG emissions from changes in foreign oil production and consumption (**Section H.2.5**). BOEM qualitatively considers other changes in foreign markets, including changes in foreign oil midstream emissions and energy market substitutions, but cannot quantify these at this time (**Section H.4**).

[3] In a comment on the 2024-2029 National OCS Oil and Gas Program, the USEPA stated: "[A] No Action Alternative with no new lease sales or substitution…serve[s] as a baseline of comparison for greenhouse gas (GHG) emissions among the action alternatives. …For actions involving resource substitution, current CEQ GHG Guidance (January 2023) encourages agencies to conduct a 'substitution analysis' to provide more information on how the proposed action is projected to affect the resulting resource or energy mix, including resulting GHG emissions. …Ideally, BOEM would estimate the displaced sources from the substitution and their accompanying emissions to calculate net emissions for the action alternatives. Displacement or substitution emissions should be accounted for in the action alternatives." (Tomiak 2023)

Table H.2-1. BOEM's Proposed Action GHG Emissions Analysis: Modeling Capability in Quantifying GHG Emissions by Life Cycle Components.

Emissions Source	Upstream	Midstream	Downstream
Domestically Produced or Consumed Energy – New OCS oil and natural gas production	Quantified (**Table H.2-5**)	Quantified (**Table H.2-7**)	Quantified (**Table H.2-7**)
Domestically Produced or Consumed Energy – Displaced substitute energy sources	Quantified (**Table H.2-5**)	Quantified (**Table H.7**)	Quantified (**Table H.2-7**)
Non-U.S. Consumed Energy – Foreign oil market change	Quantified* (**Table H.2-12**)	Under consideration but unavailable at this time	Quantified* (**Table H.2-14**)
Non-U.S. Consumed Energy – Displaced substitutes for oil in foreign markets (natural gas, coal, biofuels, renewables, reduced demand)	Qualitatively discussed in **Section H.4**	Qualitatively discussed in **Section H.4**	Qualitatively discussed in **Section H.4**

* Foreign oil production and consumption are not modeled as dynamically as domestic oil production and consumption. The Market Simulation Model's estimate of the foreign oil market does not include cross-price effects (refer to **Section H.4**).

The resulting analysis indicates that, when considering only emissions associated with domestically produced or consumed energy, selection of the proposed action results in total GHG emissions that are very close to baseline level emissions under the No Action Alternative. However, when the analysis is expanded to also consider emissions from foreign energy markets, BOEM finds the proposed action results in higher global GHG emissions. BOEM recognizes that many variables are uncertain within its life cycle GHG analysis and considers some of these uncertainties in **Section H.5**. After estimating GHG emissions, BOEM then monetizes the social costs of those GHG emissions to estimate the total SC-GHG emissions attributable to the proposed action.

H.2.2 Life Cycle GHG Methodology

BOEM's life cycle greenhouse gas methodology was first described in 2016 (Wolvovsky and Anderson 2016). The methodology has been updated in the *Gulf of Mexico GHG Analysis Updates for Lease Sale 261* (BOEM 2023b), as well as the *Economic Analysis Methodology for the 2024–2029 National Outer Continental Shelf Oil and Gas Leasing Program* (BOEM 2022; 2023a). The scope of BOEM's quantitative greenhouse gas analysis includes entire life cycle (upstream, midstream, and downstream) GHG emissions from domestically produced or consumed energy, as well as the upstream and downstream GHG emissions from a shift in foreign oil production and consumption under the proposed action. BOEM's life cycle greenhouse gas analysis relies on three BOEM models to estimate results: Market Simulation Model (MarketSim) (Industrial Economics Inc. 2023a);[4] Offshore Environmental Cost Model (OECM) (Industrial Economics Inc. 2018; 2023b);[5] and

[4] Available online at https://www.boem.gov/oil-gas-energy/energy-economics/national-ocs-program.
[5] Available online at https://www.boem.gov/oil-gas-energy/energy-economics/national-ocs-program.

Greenhouse Gas Life Cycle Emissions Model (GLEEM) (Wolvovsky 2023).[6] For a full description of these models, please refer to their documentation and associated reports.

BOEM acknowledges that these models were developed for analysis at a national level and that there may be limitations on the scalability of the models to this regional analysis. However, the models incorporate a regional framework and specify assumptions by Gulf of Mexico OCS planning area (e.g., Western and Central Planning Areas) when applicable. The models represent the best science and methodology available for estimating energy market impacts, rates of displacement of the substitution energy sources, and emissions rates, which are relevant factors in the larger analysis and comparison of GHG emissions that could occur under the proposed action.

When estimating emissions, BOEM's models quantify the three main GHGs: CO_2, CH_4, and N_2O. To provide a single metric for estimating and comparing an alternative's emissions profiles, BOEM provides combined totals of all three GHG emissions in CO_2 equivalent (CO_2e). This approach allows for a direct, aggregate comparison between emissions of pollutants with varying potentials to trap heat and different atmospheric lifespans, known as Global Warming Potential (GWP). For example, 1 metric ton of CH_4 has an impact similar to 25 metric tons of CO_2. This analysis uses 100-year GWP developed by the USEPA (USEPA 2021a) (**Table H.2-2**).

Table H.2-2. Global Warming Potential (in metric tons).

Greenhouse Gas	**CO_2**	**CH_4**	**N_2O**
Global Warming Potential (CO_2e)	1	25	298

Source: USEPA (2021a).

In response to stakeholder comments, BOEM also provides an Excel file with the GHG emissions showing specific annual estimates of CO_2, CH_4, and N_2O (https://www.boem.gov/environment/environmental-assessment/gulf-mexico-regional-ocs-oil-and-gas-programmatic, under the Supporting Information tab). This file allows for the conversion of emissions to CO_2e using other GWP values such as the Intergovernmental Panel on Climate Change's 100 year GWP. The International Panel on Climate Change's GWPs represent the most recently updated values, addressing the shorter atmospheric lifespan of CH_4 in their 20-year GWP, which also uses specialized GWPs for CH_4 released from fossil fuels, including natural gas that can be released as part of oil and gas operations (e.g., fugitive emissions or flaring). Meanwhile, the U.S. Environmental Protection Agency's GWP values are the basis for the Paris Agreement emission reduction targets.

[6] Available online at https://www.boem.gov/environment/greenhouse-gas-life-cycle-energy-emissions-model.

BOEM evaluates life cycle GHG emissions assuming annual exploration, development, and production occur as estimated under three different activity level scenarios (i.e., low, mid-, and high).[7] To estimate the volume of substitute energy sources displaced by new OCS oil and natural gas under a given proposed action's potential exploration and development production scenarios, BOEM uses MarketSim. The substitute estimates are then used as inputs in the OECM and GHG Model (**Figure H.2-3**).

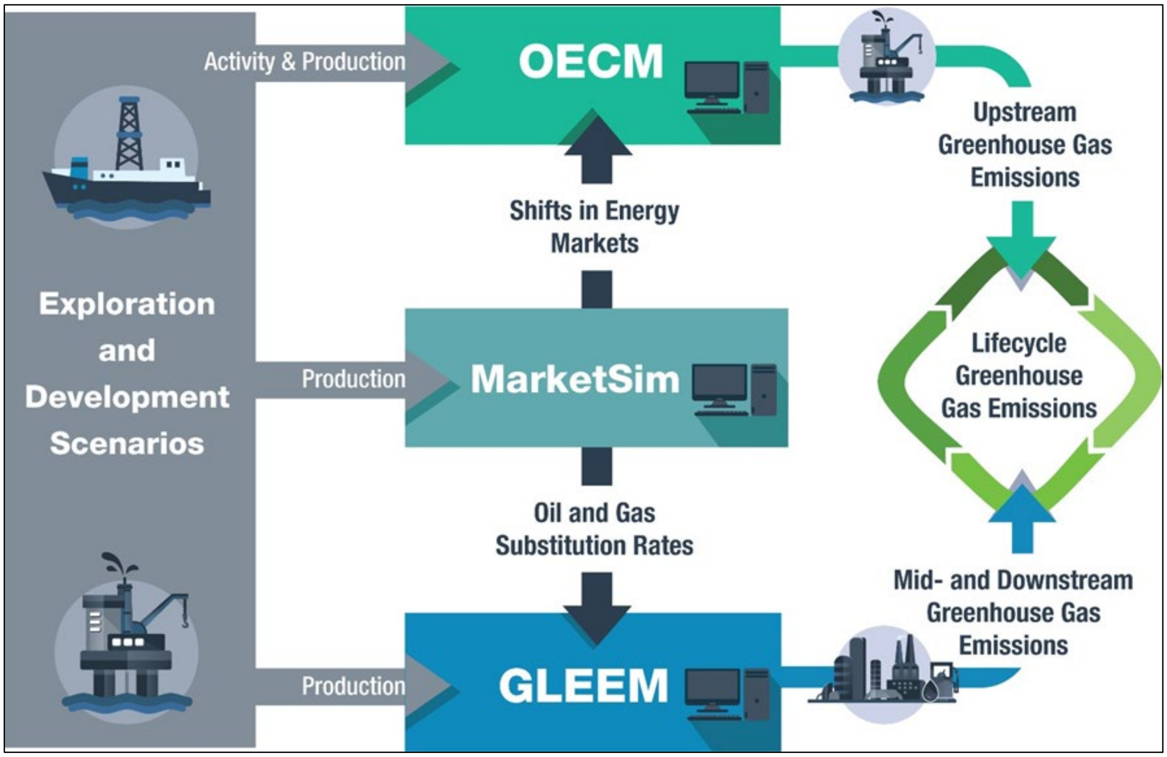

Figure H.2-3. Illustration of BOEM's Models and Methodology.

H.2.2.1 MarketSim Model

MarketSim is a Microsoft Excel-based model for the oil, gas, coal, and electricity markets. BOEM uses MarketSim to estimate the energy commodity price changes expected to occur with new OCS oil and gas production and then calculate the displacement of energy market substitutes (refer to **Table H.2-4**) that would occur given those price changes (e.g., the volumes of substitute oil and natural gas imports, domestic onshore oil and gas, and renewable energy displaced by new OCS oil and gas production).

MarketSim's baseline is adapted from a special run of the Energy Information Administration's National Energy Modeling System (NEMS). BOEM requested specialized runs from the Energy

[7] To generate estimates of anticipated future oil and gas production, BOEM develops oil and gas exploration and development scenarios under a given leasing schedule to describe the development and production activities required to explore for, extract, and transport to market the anticipated oil and gas production. For this analysis, BOEM uses the single oil and gas lease sale low, mid-, and high activity level scenarios that were updated based on the Secretary of the Interior's decision for the 2024-2029 National OCS Oil and Gas Leasing Program.

Information Administration that modified the 2023 AEO Reference Case to remove new OCS oil and gas lease sales and associated production starting in 2023 (Energy Information Administration 2023; Sommer 2023). Removing the expected production from new OCS leasing from Energy Information Administration's projections allows BOEM to use MarketSim to investigate the impact of alternative new OCS leasing scenarios and associated production within the EIA's broad energy market projections.

MarketSim makes no assumptions about future technology or policy changes other than those reflected in the Energy Information Administration's NEMS forecast (Industrial Economics Inc. 2023a). The Energy Information Administration's 2023 AEO Reference Case reflects current laws and policies. As such, the baseline used in MarketSim includes impacts from IRA provisions modeled by the Energy Information Administration. Due to the complexities of the IRA, not all provisions were modeled in the AEO given uncertainty over the structure of implementation details. Details on the IRA provisions excluded from the 2023 AEO Reference Case are included in the 2023 AEO Narrative Appendix (Energy Information Administration 2023).

Meeting U.S. climate goals will require significant changes to national and worldwide economies beyond those projected within the 2023 AEO and MarketSim's baseline. Accordingly, BOEM has conducted a sensitivity analysis to estimate the impacts of these potential net-zero emissions pathways. Section H.5.2 includes more information on the sensitivity analysis, but for further details on methodology, modeling assumptions and results refer to Chapter 4 of the Final EAM paper, and the appendix to the MarketSim documentation (BOEM 2023a and Industrial Economics Inc. 2023a).

For each of the scenarios analyzed, BOEM adds the estimate of future production from a proposed lease sale into MarketSim as an addition to the energy market baseline. MarketSim uses price elasticities[8] and adjustment rates[9] to calculate a new energy market equilibrium and the volumes of substitute energy sources displaced by the potential OCS production under the proposed action. Collectively, elasticities and adjustment rates determine the change in supply and demand of alternative energy sources given a change in the anticipated production from the proposed action scenarios. MarketSim evaluates a series of simulated price changes until each fuel market reaches equilibrium where supply equals demand. The differences between the baseline and simulated supply and demand provide BOEM the necessary data to use in the OECM and GLEEM to estimate GHG emissions from the OCS oil and gas as well as those from the displaced energy substitutes. Additional details about how MarketSim models energy market equilibrium and displacements of energy market substitutes are described in the MarketSim documentation (Industrial Economics Inc. 2023a).

Table H.2-3 shows the volumes of oil and natural gas potential production of the proposed action at three different activity levels. **Table H.2-4** shows the amount of displaced energy sources as

[8] Elasticity, simply defined, is a mathematical value that expresses the percent change expected in one economic variable given a 1% change in another economic variable (e.g., supply, demand, or price).

[9] Adjustment rates are the limits MarketSim sets on how much of the long-term change estimated by the elasticity values can occur in 1 year.

a percentage of the potential OCS production. For example, 55 percent of the estimated 933.0 million barrels of oil equivalent (MMBOE) production in the proposed action high activity scenario (501.4 MMBOE) represents a reduction in net imports that were displaced by OCS production. The model estimates that 9 to 11 percent of the OCS production does not displace any energy source and represents additional demand under the proposed action.

Table H.2-3. Proposed Action Potential Production by Activity Level (in MMBOE).

Potential OCS Production (MMBOE)	Low Activity Level	Mid-Activity Level	High Activity Level
Oil	55.3	326.1	755.8
Natural Gas	13.8	66.6	177.3
Total	69.0	392.7	933.0

Note: Natural gas volumes are typically given in thousand cubic feet (Mcf). For ease of comparing oil to natural gas volumes, BOEM converted from Mcf to MMBOE using the equivalency assumption of 5.620 Mcf/BOE.

Table H.2-4. Displaced Energy Sources as a Percentage of Proposed Action Oil and Natural Gas Production.

Substitute Energy Source	Low Activity Level	Mid-Activity Level	High Activity Level
Onshore Production	26	24	24
Onshore Oil	13	13	13
Onshore Gas	13	10	11
Production from Existing State/Federal Offshore Leases	1	1	*
Imports	54	56	55
Oil Imports	53	55	54
Gas Imports	1	1	1
Coal	*	*	*
Electricity from Sources Other Than Coal, Oil, and Natural Gas**	1	1	1
Other Energy Sources***	8	8	8
Increased Energy Demand (energy not displaced)	9	10	11

Notes: The estimates in this table represent the volume of a specific substitute energy source (as the percent of potential OCS production) that is displaced by new OCS production (or in the case of the last row, energy not displaced which is an increase in demand) with the selection of the proposed action. For example, the volume of onshore natural gas displaced by new OCS production is estimated at 11% of potential proposed action production at the high activity level. Numbers may not sum due to rounding.

* Value is less than 0.5% and thus rounds to 0%.

** Includes electricity from wind, solar, nuclear, and hydroelectric sources. BOEM does not assign life cycle GHG emissions to these energy sources. For the upstream, BOEM does not currently have the data needed to determine how much renewable energy generation is reduced by either curtailing utilization of existing capacity or building of new capacity in the GOM. For the midstream, only nuclear would have modeled emissions, which would be de minimis. None of these sources would have any downstream emissions.

*** Includes primarily natural gas liquids (roughly 80%), with the balance from biofuels, refinery processing gain, product stock withdrawal, liquids from coal, and “other” natural gas not captured elsewhere. BOEM does not assign upstream, midstream, or downstream GHG emissions with biofuels, which is a very small portion of "Other Energy Sources" that would be de minimis.

H.2.2.2 OECM and Upstream GHG Emissions Estimates

BOEM uses the OECM to estimate upstream emissions from OCS production and displaced energy sources (Industrial Economics Inc. 2018; 2023b). The OECM uses the level of exploration, development, and production activities associated with the potential production to estimate the OCS upstream GHG emissions. BOEM's upstream emissions factors for OCS oil and natural gas activities and substitutes can be found in Table 5 of the OECM documentation (Industrial Economics Inc. 2023b).[10]

H.2.2.3 GLEEM: Midstream and Downstream GHG Emissions Estimates

GLEEM uses potential production and MarketSim's displacement percentages to generate the midstream and downstream GHG emissions estimates. The model calculates the emissions associated with onshore processing (refining and storage), delivery of energy (i.e., oil, natural gas, or other displaced energy substitutes) to the final consumer, and consumption of the oil and gas products. GLEEM relies on the MarketSim displacement percentages to estimate midstream and downstream emissions from displaced energy substitutes under the proposed action scenarios. More details on GLEEM are available in the model documentation (Wolvovsky 2023).

H.2.3 Life Cycle Greenhouse Gas Emission Estimates: Domestically Produced or Consumed Energy

Table H.2-5 shows the GHG emissions estimates for OCS production and displaced energy substitutes. The first row shows the estimate of GHG emissions from upstream activities under the proposed action. These are the emissions specifically associated with the exploration, development, and production of the resources on the OCS resulting from a single proposed OCS oil and gas lease sale. To fully capture the GHG impacts associated with this production, as described in the previous section, BOEM uses the MarketSim to estimate the resulting changes in energy markets associated with this new OCS production. BOEM models the changes in other energy sources in response to the production from the proposed action. The emissions associated with these displaced energy sources are included in the second row. These emissions are negative as they are emissions that will not occur under the proposed action but would have occurred without the OCS production expected from the proposed action. The sum of these two estimates is the total proposed action emissions, which is shown in the last row.

[10] The OECM estimates emissions from upstream activity, which includes (1) propulsion and auxiliary engines operated onboard vessels, (2) drilling operations, (3) platform operations including flaring, (4) helicopters and light aircraft, (5) use of above-ground pipelines, (6) construction (onshore and offshore), and (7) accidental oil spills and gas releases.

Table H.2-5. Upstream GHG Emissions from Domestically Produced or Consumed Energy (in thousands of metric tons).

	Low Activity Level				**Mid-Activity Level**				**High Activity Level**			
	CO_2e	CO_2	CH_4	N_2O	CO_2e	CO_2	CH_4	N_2O	CO_2e	CO_2	CH_4	N_2O
OCS Oil & Gas Emissions*	124	121	**	**	1,651	1,438	8	**	4,927	4,396	19	**
Displaced Energy Emissions*	-2,880	-1,917	-38	**	-16,580	-11,072	-219	**	-38,603	-25,776	-509	**
Total Proposed Action Emissions***	-2,756	-1,796	-38	**	-14,928	-9,634	-211	**	-33,676	-21,380	-490	**

Note: Values rounded to nearest 1,000 metric tons.

* Upstream OCS Oil & Gas Emissions include GHG emissions from the transport of U.S. gross oil exports. Upstream Displaced Energy Emissions include the GHG emissions from the change in the production and transport to U.S. shores of U.S. gross oil imports. When added together, this ensures that upstream total proposed action emissions account for the change in U.S. net oil imports.

** Values are between -0.5 and 0.5.

*** The total proposed action emissions are the emissions associated with the OCS oil and gas plus those of the displaced energy sources. These are the total GHG emissions attributable to the proposed action, i.e., row 1 plus row 2.

As described earlier, BOEM has reframed its analysis regarding how energy substitutes are presented. **Table H.2-6** shows BOEM's previous format, where emissions from energy substitutes are presented as occurring under the No Action Alternative. The No Action Alternative in the current approach is considered to have no emissions and is not shown in **Table H.2-5**. As described, the resulting GHG emissions attributable to the proposed action remain the same, whether they are presented as total proposed action emissions or as the difference between the proposed action and the No Action Alternative emissions.

Table H.2-6. Previous Format: Upstream GHG Emissions from Domestically Produced or Consumed Energy (in thousands of metric tons).

	Low Activity Level				**Mid-Activity Level**				**High Activity Level**			
	CO_2e	CO_2	CH_4	N_2O	CO_2e	CO_2	CH_4	N_2O	CO_2e	CO_2	CH_4	N_2O
Proposed Action	124	121	*	*	1,651	1,438	8	*	4,927	4,396	19	*
No Action Alternative	2,880	1,917	38	*	16,580	11,072	219	*	38,603	25,776	509	*
Difference	-2,756	-1,796	-38	*	-14,928	-9,634	-211	*	-33,676	-21,380	-490	*

Note: Values rounded to nearest 1,000 metric tons.

* Values are between -0.5 and 0.5.

For the upstream portion of life cycle emissions, BOEM estimates about 4.9 million metric tons of CO_2e would be emitted from OCS oil and natural gas activity and production at the high activity level. However, because of that production, other energy sources would not be produced (i.e., they would be "displaced"). Those sources would have generated 38.6 million metric tons of CO_2e

upstream emissions. The OCS oil and gas emissions are only 13 percent of those that are displaced, resulting in a reduction in emissions from upstream activities under the proposed action.

Collectively, the displaced substitute energy sources have higher GHG emissions per unit of production (also known as “GHG intensity”) compared to OCS oil and natural gas. In general, the highest GHG intensive projects are those that flare or vent substantial amounts of natural gas and those that are late in their life cycle[11]. Deepwater GOM upstream oil and gas production is generally characterized as having some of the lowest GHG intensity of global oil production (ICF International 2023; Kennett et al. 2023; Oberstoetter 2021). The deepwater GOM’s low GHG intensity is due to several factors. The deepwater GOM has efficiencies stemming from generally larger projects and the U.S. regulatory environment. Larger projects lead to greater well productivity leading to lower energy use and lower methane emissions per BOE. The GOM regulatory environment also includes restrictions on venting and flaring of OCS natural gas to further lower the carbon intensity of OCS production (ICF International 2023). Further, deepwater projects are earlier in their life cycle, have higher production volumes, and the facilities are designed with technological advancements to reduce GHG emissions (Kennett et al. 2023). Thus, while extraction of crude oil from the GOM OCS would certainly lead to GHG emissions, the production of GOM OCS crude is associated with fewer upstream GHG emissions than the modeled displaced oil substitutes used to meet consumer demands in the absence of the proposed action.

Table H.2-7 shows the midstream and downstream emissions associated with the proposed action. Mid- and downstream emissions from OCS oil and gas are larger than those of the displaced substitutes, resulting in an increase in emissions over the baseline. This increase is due to the slightly higher energy consumption and fuel switching towards OCS natural gas and oil under the proposed action. BOEM calculates that, under the proposed action, the additional OCS production would result in slightly lower oil prices than under the No Action Alternative baseline.[12] With the lower energy prices, MarketSim estimates that all domestic energy demand over the 34-year production would be 105.5 MMBOE higher for the high activity level (roughly 11.3% of the OCS production). For oil and natural gas specifically, MarketSim estimates U.S. consumption to be higher by 56.9 million barrels of oil and 89.4 billion cubic feet of natural gas under the proposed action at the high activity level. Although oil and natural gas demand are expected to be higher in the proposed action, BOEM anticipates that there would be a reduction in onshore production (mainly natural gas) and imports (mainly oil), in addition to lower coal production and consumption.

At the high activity level, BOEM estimates that OCS oil and gas would emit 300.2 million metric tons of CO_2e from midstream and downstream activities associated with the proposed action. This

[11] The GHG intensity is generally lowest when a facility is at peak production and, barring technology improvements, increases as facilities age and the production volumes decrease. As a facility ages and a reservoir becomes increasingly depleted, more effort is required for every barrel as the concentration of the oil in the extracted mix decreases. It takes more energy and resources to extract and separate out that oil from the extracted mix.

[12] The average price reductions under the proposed action relative to baseline over the 34 years of oil and natural gas production at the high activity level are $0.11 per barrels for oil, $0.002 per thousand cubic feet for natural gas, $0.0008 per ton for coal, and $0.002 per kilowatt hour for electricity.

displaces 261.7 million metric tons of CO_2e, resulting in total proposed action midstream and downstream emissions of 38.5 million metric tons of CO_2e.

Table H.2-7. Midstream and Downstream GHG Emissions from Domestically Produced or Consumed (in thousands of metric tons).

	Low Activity Level				Mid-Activity Level				High Activity Level			
	CO_2e	CO_2	CH_4	N_2O	CO_2e	CO_2	CH_4	N_2O	CO_2e	CO_2	CH_4	N_2O
OCS Oil & Gas Emissions	22,192	21,957	7	*	126,439	125,226	37	1	300,173	297,091	97	2
Displaced Energy Emissions	-19,853	-19,666	-6	*	-111,916	-110,979	-27	-1	-261,673	-259,402	-67	-2
Total Proposed Action Emissions**	2,339	2,291	2	*	14,522	14,246	10	*	38,500	37,689	30	*

Note: Values rounded to nearest 1,000 metric tons.

* Values are between -0.5 and 0.5.

** The total proposed action emissions are the emissions associated with the OCS oil and gas plus the reductions associated with displaced energy substitutes. These are the total GHG emissions attributable to the proposed action, i.e., row 1 plus row 2.

Table H.2-8 shows the life cycle GHG emissions estimates. At all activity levels, the GHG emissions from OCS oil and gas are close to the volume of displaced GHG emissions from substitute energy sources. The modeling indicates that under the proposed action there are slightly fewer emissions at the low and mid-activity levels (decreases of 1.8% and 0.3%, respectively) but slightly higher emissions in the high activity level (increase of 1.6%).

Table H.2-8. Full Life Cycle GHG Emissions from Domestically Produced or Consumed (in thousands of metric tons).

	Low Activity Level				Mid-Activity Level				High Activity Level			
	CO_2e	CO_2	CH_4	N_2O	CO_2e	CO_2	CH_4	N_2O	CO_2e	CO_2	CH_4	N_2O
OCS Oil & Gas Emissions	22,315	22,078	7	*	128,090	126,664	45	1	305,100	301,487	116	2
Displaced Energy Emissions	-22,732	-21,583	-44	*	-128,496	-122,052	-246	-1	-300,276	-285,178	-576	-2
Total Proposed Action Emissions**	-417	495	-36	*	-406	4,612	-201	*	4,824	16,309	-460	*

Note: Values rounded to nearest 1,000 metric tons.

* Values are between -0.5 and 0.5.

** The total proposed action total emissions are the emissions associated with the OCS oil and gas plus the reductions associated with displaced energy substitutes. These emissions are the total GHG emissions attributable to the proposed action, i.e., row 1 plus row 2.

Small changes in the exploration and development activity, the volumes of oil to natural gas production within the proposed action scenarios, and underlying assumptions within the models could lead to different results. The primary modeling assumptions affecting the results are elasticities, adjustment rates, differences in emission factors, and regional energy market differences. The interplay of all these variables, along with projected activity levels and the ratio of oil versus natural gas production within the exploration and development scenario, drive differences in GHG emissions estimates between new OCS production and displaced energy substitutes. The factors contributing to uncertainty are discussed in **Section H.5**.

H.2.4 Life Cycle Emissions Compared to Targets and Carbon Budgets

The Paris Agreement, to which the U.S. is a party, requires countries to set goals to help stabilize atmospheric GHG concentrations at a level that would limit anthropogenic interference with the climate system to keep the global average temperature increase to within 2 °C (3.6 °F), and preferably to within 1.5 °C (2.7 °F), of pre-industrial levels. These intermediate goals, which are on the pathway to global net-zero emissions, are referred to as Nationally Determined Contributions (NDCs) (United Nations Framework Convention on Climate Change 2015). The U.S. set its NDCs using domestic emissions from a base year of 2005. In 2005, U.S. net emissions were 6.68 billion metric tons of CO_2e (USEPA 2021b). The U.S. achieved its 2020 goal to reduce its net GHG emissions by 17 percent below 2005 levels, in part due to the coronavirus pandemic. Currently, the U.S. has established NDCs for 2025 and 2030, each with a 2-percentage-point range (The White House 2021b). **Table H.2-9** lists the current emissions targets. The U.S. has an additional goal of net-zero emissions by 2050 (U.S. Department of State and U.S. Executive Office of the President 2021); this target is outside of the Paris Agreement framework.

Table H.2-9. U.S. Domestic GHG (CO_2e) Reduction Targets.

Target Year	Target Net Reduction (from 2005)	Target Net Emissions (Current) of CO_2e (in thousands of metric tons)
2025[a]	26-28%	4,943,422-4,809,816
2030[a]	50-52%	3,340,150-3,206,544
2050[b]	100%	0

[a] Target submitted to the United Nations as part of the U.S. Nationally Determined Contribution.
[b] Target established outside of the Paris Agreement framework.

Table H.2-10 compares the estimated emissions from the target year to the United States' NDCs and shows the percentage of the target that is expected to be consumed by OCS oil and natural gas, as well as mitigated by displacing substitute energy, under the proposed action. **Table H.2-10** begins with year 2026 in the comparison because there are no estimates of GHG emissions under the proposed action in 2025 (the year of the first scheduled OCS oil and gas lease sale) at any of the three activity level scenarios. The percentages in **Table H.2-10** likely show a worst-case scenario for 2030, as there is the potential for carbon capture and storage to allow for higher emissions than the targets, while still achieving the NDCs. By 2050, to achieve the net-zero emissions target, all GHG emissions would have to be offset by removal of an equal CO_2e amount of GHGs from the atmosphere, including those resulting from any OCS development. As **Table H.2-10** shows, OCS oil and natural gas are expected to release similar amounts of CO_2e compared to the displaced substitute energy sources. Note that the emissions for both the OCS oil and gas and displaced energy substitutes in **Table H.2-10** include some emissions that would occur outside of the U.S., but BOEM is currently unable to isolate just the domestic emissions. Instead, these values represent the emissions that result from supplying the U.S. market.

Table H.2-10. U.S. Emissions Target Reductions Comparison Between the GHG Emissions of OCS Oil and Natural Gas Versus Those of the Displaced Substitute Energy Sources under the Proposed Action (CO_2e, in thousands of metric tons).

Activity Level	Target Year	OCS Oil & Gas CO_2e	Displaced Energy Substitutes CO_2e	Total Proposed Action CO_2e*	Proposed Action as % of U.S. Targets
Low Activity Level	2030	607	-595	12	0.0004% to 0.0004%
Low Activity Level	2050	**	**	**	***
Mid-Activity Level	2030	1,702	-1,597	105	0.0031% to 0.0033%
Mid-Activity Level	2050	3,773	-3,822	-49	***
High Activity Level	2030	3,990	-3,552	438	0.0131% to 0.0137%
High Activity Level	2050	8,677	-8,752	-74	***

Notes: Percentages represent the amount of the U.S. targets that are estimated to be consumed by new leasing on the OCS beyond what would be consumed by displacement of energy substitutes.

* The total proposed action total emissions are the emissions associated with the OCS oil and gas plus the reductions associated with displaced energy sources. These emissions are the total GHG emissions attributable to the proposed action, i.e., column 3 plus column 4).

** Signifies no anticipated emissions in reference year. The low activity scenario's last year of production is 2046.

*** Percentage of the 2050 targets consumed by OCS production, or its substitutes, is blank because by 2050 an equal amount of emissions would have to be removed from the atmosphere to achieve the net-zero emissions target. However, if the amount of emissions removed in 2050 is in fact less than the amount emitted, then any amount of emissions will exceed the U.S. target for 2050.

Carbon budgets are different from NDCs set by governments in that they project the amount of global emissions that can be emitted before a certain amount of warming occurs. These budgets can be indexed to different global average temperature increases, but most focus on the 1.5 C (2.7 F) and 2 C (3.6 F) targets outlined in the Paris Agreement. Estimates of the remaining CO_2 emissions left in the global carbon budget vary, but they largely center around 1 trillion metric tons of CO_2 remaining (Friedlingstein et al. 2022; Intergovernmental Panel on Climate Change 2021).

Beyond seeking to reduce future emissions, another approach being aggressively pursued is carbon capture and storage. This approach could effectively increase the carbon budget by capturing and sequestering atmospheric or oceanic carbon allowing for additional carbon emissions. The technology is relatively new and, though the OCS would likely play a role in carbon capture and storage, efforts are currently in their infancy. With or without large-scale carbon capture and storage projects, new emissions from OCS development or substitute sources of energy would count against the planet's carbon budget.

H.2.5 Foreign GHG Emissions Methodology and Estimates

BOEM's foreign GHG emissions analysis estimates the change in global emissions not captured in the domestic life cycle GHG emissions analysis. Because GHG emissions are a global pollutant, the emissions associated with foreign activities impact the U.S. The goal of the foreign GHG analysis is to consider the impact that the proposed action has on global GHG emissions while accounting for those emissions that are not already captured within the domestic GHG emissions analysis. Because oil is a global commodity, any price changes resulting from OCS production would impact global production and consumption. BOEM first uses MarketSim to estimate changes in foreign oil production and consumption. Then, using the best available information, BOEM converts the changes in global oil production and consumption into a change in GHG emissions. **Section H.2.5.1** explains BOEM's calculation of foreign upstream emissions, and **Section H.2.5.2** explains BOEM's calculations for foreign downstream emissions.

As described in **Section H.4**, foreign energy market simulations using MarketSim are necessarily more simplistic given limited information available for foreign markets when compared to that available for the U.S. domestic energy markets. BOEM uses MarketSim's current assumptions to estimate shifts in foreign oil markets in response to OCS leasing decisions but acknowledges that the foreign analysis is less detailed than the domestic analysis. BOEM expects to continue to make refinements to its foreign GHG analysis as data and methodologies develop for future analyses.

H.2.5.1 Foreign Oil Upstream Methodology and Estimates

Since BOEM's recent GHG analyses for GOM Lease Sale 259 and 261[13], BOEM has expanded its foreign GHG emissions methodology to include estimates of the change in foreign oil's upstream GHG emissions. BOEM uses MarketSim's estimate of the change in foreign oil production caused by the proposed action but adjusts that result to account for emissions already considered in the domestic analysis.

BOEM first considers the overall change in foreign oil production and subtracts the change in foreign oil exports to the U.S. (U.S. gross oil imports) as they are already accounted for in BOEM's domestic analysis. Life cycle GHG emissions from U.S. gross oil imports are included in the displaced energy substitutes emissions within the domestic analysis.

As shown in **Table H.2-11**, at the high activity level, BOEM's modeling suggests that the proposed action results in a decrease of 334 million barrels of foreign oil production. However, BOEM's domestic analysis already accounts for the displaced emissions associated with 479 million barrels of U.S. gross oil imports (foreign gross oil exports). The difference (479-334) represents foreign oil production available for foreign consumption under the proposed action instead of as exports to the U.S. Because BOEM already accounted for the reduction in life cycle emissions

[13] *Gulf of Mexico OCS Oil and Gas Leasing Greenhouse Gas Emissions and Social Cost Analysis: Addendum to the Gulf of Mexico Lease Sales 259 and 261 Supplemental EIS and Technical Report – Corrected* (BOEM 2023c); and *Gulf of Mexico GHG Analysis Updates for Lease Sale 261* (BOEM 2023b).

associated with the displaced U.S. gross oil imports, the foreign analysis accounts for the upstream emissions associated with the 145 million barrels available for foreign consumption.

Table H.2-11. Increase in Foreign Oil Supply under the Proposed Action (in millions of barrels).

	Low Activity Level	Mid-Activity Level	High Activity Level
Change in Foreign Oil Production under the Proposed Action	-25	-146	-334
Change in Foreign Oil Exports to U.S.	-35	-206	-479
Adjusted Change in Foreign Oil Supply (row 1 minus row 2)	10	61	145

Note: Change in foreign oil exports to the U.S. is equivalent to the change in U.S. oil imports. The adjusted change in foreign oil supply shown here is the decrease in foreign oil production minus the decrease in foreign oil exports to the U.S. It does not add U.S. oil exports since these were not subtracted from the domestic analysis and are already accounted for when taking a global view.

The difference of 145 million barrels shown in **Table H.2-11** plus an increase in U.S. oil exports is the supply necessary for the increase in foreign consumption of 164 million barrels under the proposed action shown in **Table H.2-13**. In other words, the increase in foreign consumption, due to lower oil prices resulting from increased OCS production under the proposed action, is fulfilled by an increase in U.S. oil exports and a decrease in foreign oil exports to the U.S (i.e., U.S. oil imports).

BOEM then applies the same OECM emissions factor used for overseas oil production that is exported to the U.S. to the estimate of the annual change in foreign oil supply shown in **Table H.2-11**. BOEM assumes the change in foreign oil production would have the same GHG emissions factor as the foreign oil that is produced and exported to the U.S. This simplifying assumption is necessary and appropriate given the lack of information on the specifics of where foreign oil production could change in response to OCS production. **Table H.2-12** shows the increase in foreign upstream GHG emissions associated with the increase in foreign oil supply shown in **Table H.2-11**.

Table H.2-12. Foreign Upstream: Increase in Oil Supply GHG Emissions under the Proposed Action (in CO_2e, thousands of metric tons).

	Low Activity Level				Mid-Activity Level				High Activity Level			
	CO_2e	CO_2	CH_4	N_2O	CO_2e	CO_2	CH_4	N_2O	CO_2e	CO_2	CH_4	N_2O
Foreign Oil Upstream Emissions	562	389	7	*	3,487	2,413	43	*	8,295	5,741	102	*

Note: CO_2e conversions are made using the USEPA's 100-Year GWP values of 25 for CH_4 and 298 for N_2O. Detailed tables of annual GHG emissions and alternative CO_2e values based on alternate GWP values are published on BOEM's website (https://www.boem.gov/environment/environmental-assessment/gulf-mexico-regional-ocs-oil-and-gas-programmatic, under the Supporting Information tab).

* Values are between -0.5 and 0.5.

H.2.5.2 Foreign Oil Downstream Methodology and Estimates

BOEM's MarketSim model estimates the increase in foreign oil consumption that occurs under the proposed action. However, some of that increase in oil consumed in foreign markets is already included in BOEM's greenhouse gas emissions analysis of domestically produced or consumed energy. This is because BOEM's domestic downstream analysis treats the full value of the proposed action's exploration and development scenarios' potential OCS oil and gas production as being consumed domestically. However, a small amount of that OCS oil is exported and consumed in foreign markets. Thus, when extending the analysis to include foreign consumption, an adjustment is necessary. BOEM adjusts MarketSim's foreign oil consumption estimate to account for the amount that are already included within the domestic downstream analysis. The adjusted increase in foreign oil consumption is presented in **Table H.2-13**. BOEM continues to review and refine its foreign emissions methodology and could further refine this change for future analyses.

Table H.2-13. Increase in Foreign Oil Consumption (adjusted) Resulting from the Proposed Action (in millions of barrels).

Step of Adjustment (description)	Low Activity Level	Mid-Activity Level	High Activity Level
A. Global (domestic plus foreign) shift in oil consumption estimated by MarketSim	15.0	94.6	224.5
B. Shift in U.S. domestic oil consumption used in GLEEM	3.9	25.7	60.6
C. (A minus B) Adjusted shift in foreign oil consumption*	11.1	68.9	163.9

GLEEM takes the adjusted annual change in foreign consumption and applies an emissions factor attributable to combusted oil. For this analysis, BOEM uses a single set of USEPA emissions factors called "Other Oil <401°F" (USEPA 2023a). This emissions factor set is a miscellaneous factor used when the end petroleum product consumed is unknown. Typically, rather than using a single emissions factor, it would be preferable to use a range of emissions factors that correspond to the different end uses of petroleum products after oil refining. However, for this analysis, BOEM applies this emissions factor to all combusted oil due to a lack of information about the end petroleum products consumed in foreign markets, as the consumption of oil and its end uses vary from country to country. GLEEM's calculations for non-combustion uses of oil is based on the U.S. market as an approximation (Wolvovsky 2023). This approach is unlikely to change the results substantially, as the amount of oil used in domestic and foreign markets in non-combustion products is small.

Although the U.S. non-combusted oil products are used as a proxy for global non-combusted oil, taking a similar approach for emissions factors would likely produce less accurate results. For instance, in 2019, the most recent year for which data are available, about 20 percent of European Union oil was consumed as motor gasoline (Eurostat 2022), while in the U.S. that portion was more than double, i.e., approximately 45 percent of all oil was consumed as motor gasoline (Energy Information Administration 2022). The different emissions factors for each type of fuel (USEPA 2021a) would likely result in substantial changes in multiple ways. This variability applies to all countries around the world, including variability in oil product consumption within the European Union. Therefore, a U.S. consumption model would not apply to most other countries and, though these figures are available for the European Union, as well as some other countries, they are not available globally. As a result, BOEM has decided to use a generic emissions factor that does not corollate with specific oil products but gives a reasonable approximation of emissions from oil consumed in other countries without introducing other uncertainties into the results.

Table H.2-14 presents the increase in GHG emissions attributable to the higher foreign consumption of oil under the proposed action. Another way to view this is that the foreign oil consumption estimated under the No Action Alternative is lower than under the proposed action. At the high activity level, the selection of the No Action Alternative results in an estimated 63.6 million metric tons of CO_2e fewer GHG emissions than if the proposed action is selected.

Table H.2-14. Foreign Downstream: Change in Oil Consumption GHG Emissions under the Proposed Action (in CO_2e, thousands of metric tons).

	Low Activity Level				**Mid-Activity Level**				**High Activity Level**			
	CO_2e	CO_2	CH_4	N_2O	CO_2e	CO_2	CH_4	N_2O	CO_2e	CO_2	CH_4	N_2O
Foreign oil downstream emissions	4,310	4,296	*	*	26,739	26,653	1	*	63,587	63,382	3	*

Note: CO_2e conversions are made using the USEPA's 100-Year GWP values of 25 for CH_4 and 298 for N_2O. Detailed tables of annual GHG emissions and alternative CO_2e values based on alternate GWP values are published on BOEM's website (https://www.boem.gov/environment/environmental-assessment/gulf-mexico-regional-ocs-oil-and-gas-programmatic, under the Supporting Information tab).

* Values are between -0.5 and 0.5.

When considering the increase in emissions associated with foreign oil production in **Table H.2-12** and the increase in emissions associated with the increase in foreign oil consumption in **Table H.2-14**, BOEM finds that foreign emissions would increase under the proposed action.

H.3 Monetized Impacts from GHG Emissions

The social cost of CO_2, N_2O, and CH_4—together, the "social cost of greenhouse gases" (SC-GHG)—are estimates of the monetized damages associated with the incremental change in GHG emissions in a given year.

On January 20, 2021, President Biden issued Executive Order 13990 (86 FR 7037), "*Protecting Public Health and the Environment and Restoring Science to Tackle the Climate Crisis.*" Section 1 of Executive Order 13990 establishes an Administration policy to, among other things, listen to the science, improve public health and protect our environment, ensure access to clean air and water, reduce greenhouse gas emissions, and bolster resilience to the impacts of climate change. Section 5 of Executive Order 13990 emphasizes how important it is for Federal agencies to "capture the full costs of greenhouse gas emissions as accurately as possible, including by taking global damages into account" and establishes an Interagency Working Group on the Social Cost of Greenhouse Gases (IWG). In February 2021, the IWG published an interim report, *Technical Support Document: Social Cost of Carbon, Methane, and Nitrous Oxide; Interim Estimates under Executive Order 13990* (Interagency Working Group on Social Cost of Greenhouse Gases 2021). BOEM has relied on and used the SC-GHG estimates published in the interim report pending a final report from the IWG. For this analysis, BOEM is updating the SC-GHG estimates based on a recent memo from the IWG. On December 22, 2023, the IWG published a memo that states the following:

> Since the research underlying the IWG's interim estimates was published, there have been a variety of developments in the scientific literature. As agencies consider

> applying the SC-GHG in various contexts, consistent with OMB Circular No. A-4 and applicable law, agencies should use their professional judgment to determine which estimates of the SC-GHG reflect the best available evidence, are most appropriate for particular analytical contexts, and best facilitate sound decision-making. (Interagency Working Group on Social Cost of Greenhouse Gases 2023).

The DOI has recently concluded its review and determined that the estimates of SC-GHG published by the USEPA in November 2023 constitute the "best available science" for purposes of Departmental decision-making and/or analysis (Malcom and Ng 2024). Thus, to comply with the recent IWG memo, and following DOI guidance, BOEM uses the SC-GHG values published by the USEPA in their report *Supplementary Material for the Regulatory Impact Analysis for the Final Rulemaking, "Standards of Performance for New, Reconstructed, and Modified Sources and Emissions Guidelines for Existing Sources: Oil and Natural Gas Sector Climate Review"* (USEPA 2023b).

The USEPA 2023 report provides social cost estimates of GHG emission impacts evaluated at an average level of statistical damages[14] using three different, near-term[15] discount rates (2.5%, 2.0%, and 1.5%) (USEPA 2023b). The USEPA report includes a set of annual SC-GHG values based on each of those near-term discount rates for each of the three main GHGs, i.e., CO_2, N_2O, and CH_4. The USEPA 2023 updated estimates address all the short-term recommendations made by the National Academies of Sciences, Engineering, and Medicine in 2017 on the IWG's 2016 SC-GHG estimates. The USEPA 2023 estimates incorporate many recent advancements in modeling technology, projecting probability distributions, quantifying uncertainty, discounting methodology, and the most recent peer-reviewed scientific literature.

With higher discount rates, future damages are more discounted and thus contribute less to the total estimated costs. Because damages from GHG emissions are long term, higher discount rates lead to lower estimates of the SC-GHG. This is evident when comparing, for example, the U.S. Environmental Protection Agency's SC-GHG at a 2.5 percent near-term discount rate versus a 1.5 percent near-term discount rate, both at average level of damages. There are sources of damages that are not, at this time, quantified in these estimates. For example, the damages associated with ocean acidification are not included in any of the three climate models. Uncertainty around those impacts is thus not captured within the SC-GHG. Also refer to the USEPA's report titled *Report on the Social Cost of Greenhouse Gases: Estimates Incorporating Recent Scientific Advances* (USEPA 2023b).

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[14] The models used to assess damages from an additional metric ton of GHG perform tens of thousands of simulations as to how that metric ton of emissions would work its way through the underlying assumptions. The model arrives at a distribution of probable damages. The average statistical values suggest that they are the average of all values simulated.

[15] The USEPA uses a dynamic discount rate that is calibrated to near-term discount rates (2.5%, 2.0%, and 1.5%) and uses a Ramsey discounting methodology. Refer to the USEPA 2023 report for details on their discounting approach (USEPA 2023b).

H.3.1 Methodology for Estimating the Social Cost of Greenhouse Gas Emissions

The SC-GHG estimates represent "the monetary value of the net harm to society associated with adding a metric ton of GHG to the atmosphere in any given year" (USEPA 2023b). This SC-GHG estimated value is specific to a given year. The SC-GHG estimates represent the value of the future stream of damages associated with a given metric ton of emissions discounted to the year of emission.

The SC-GHG estimates for each year are larger than the prior year as damages increase through time. As the USEPA report notes:

> Emissions further in the future produce larger incremental damages as physical and economic systems become more stressed in response to greater climatic change and because income is growing over time. As income grows so does the willingness to pay to avoid economic damages. (USEPA 2023b)

BOEM uses the annual SC-GHG estimates for each of the three GHGs to compute the social cost estimates of OCS oil and natural gas as well as those of the displaced energy substitutes under the proposed action. The total social cost of GHG emissions is then discounted back to a net present value (NPV) using the same discount rate as the SC-GHG. Next, the NPV for the three GHGs are aggregated to derive the total social costs of GHG emissions for OCS oil and natural gas as well that of the displaced energy substitutes under the proposed action. BOEM provides an estimate for each of these cases.

Table H.3-1 provides an example calculation of the social costs of GHG emissions for the high activity level in its peak CO_2 emitting year. Given the activity schedule, BOEM's analysis suggests that peak emissions of CO_2 for the OCS oil and natural gas activity and production within the exploration and development scenario will occur in year 2037. The first row in **Table H.15** shows the emissions estimate of CO_2, CH_4, and N_2O. The second row is the USEPA's estimate for one metric ton of each of these pollutants in year 2037 at the 2 percent discount rate and average statistical damages in 2024 dollars. The third row then provides the total social cost estimate for the 2037 emissions (line 1 multiplied by line 2).

Table H.3-1. Example of Social Cost Calculation for OCS Oil and Natural Gas from Upstream High Activity Level in 2037.

Category	Units	Carbon Dioxide (CO2)	Methane (CH4)	Nitrous Oxide (N2O)
Level of 2037 Emissions	(in metric tons)	288,029	1,200	11
USEPA SC-GHG Estimate* in 2037	2024 $/metric ton	304	3,586	89,327
Social Cost Estimate for 2037 Emissions	2024 $ (millions)	87.65	4.30	0.96

Note: 2.0% discount rate and average statistical level of damages.
Source: USEPA (2023b).

The above calculation is performed for each year of GHG emission. To arrive at a NPV of social costs, the annual amounts are then discounted back to the year of analysis using the near-term discount rate, 2.0 percent in this example, associated with the set of SC-GHG estimates.

The NPVs for each of the GHGs are aggregated to arrive at an estimated social cost for each set of SC-GHGs recommended by the USEPA. This process is repeated for every component of the emissions life cycle for both the life cycle GHG emissions from OCS oil and natural gas and those from displaced energy substitutes under the proposed action.

H.3.2 Social Cost of Greenhouse Gas Results

BOEM presents SC-GHG results separately for its domestic and foreign analyses. This keeps the estimates of the social costs of GHG emissions in alignment with the estimates of the GHG emissions. Since the social cost estimates are dependent on the GHG emissions estimates, the differences between the domestic and foreign GHG emissions social costs make it important to present them separately. This allows BOEM to highlight and maintain the differences between modeling the domestic energy response relative to the foreign market response.

H.3.2.1 Domestically Produced or Consumed Energy Life Cycle

Table H.3-2 presents BOEM's estimates of the social cost of the full life cycle GHG emissions expected from domestically produced or consumed energy under the proposed action. The total proposed action social costs represent the social costs from the full life cycle of potential OCS oil and natural gas from the proposed action plus the reductions in social costs associated with displaced domestically produced or consumed energy substitutes. As with the GHG emissions volumes, the social costs from new OCS oil and gas GHG emissions are similar to those of the displaced GHG emissions from substitute energy sources. Total proposed action social costs, which represent the social costs from new OCS oil and gas leasing GHG emissions after accounting for GHG emissions reductions due to new OCS oil and gas displacing substitute energy sources (**Table H.3-2**), range from a reduction of $7 million under low activity level to an increase of $4.7 billion above the costs associated with the No Action Alternative (Alternative A) under the high activity level scenario. In percentage terms, under the various scenarios, the impact ranges from a slight reduction in social costs of 0.2 percent of the displaced energy source estimate to an increase of 4 percent of the displaced energy source estimate. With the exception of the low activity level, the USEPA estimates generally result in an increase in emissions costs.

Table H.3-2. Social Costs of Domestic Full Life Cycle GHG Emissions ($ millions).

Emissions Source	SC-GHG Source	Discount Rate	Low Activity Level	Mid-Activity Level	High Activity Level
OCS Oil and Gas	USEPA	2.5%	3,130	17,445	41,159
OCS Oil and Gas	USEPA	2.0%	5,199	29,198	69,044
OCS Oil and Gas	USEPA	1.5%	9,040	51,113	121,112
Displaced Energy Substitutes	USEPA	2.5%	-3,137	-17,238	-39,899
Displaced Energy Substitutes	USEPA	2.0%	-5,184	-28,702	-66,597
Displaced Energy Substitutes	USEPA	1.5%	-8,977	-50,041	-116,363

Emissions Source	SC-GHG Source	Discount Rate	Low Activity Level	Mid-Activity Level	High Activity Level
Total Proposed Action Social Costs*	USEPA	2.5%	-7	207	1,260
Total Proposed Action Social Costs*	USEPA	2.0%	15	496	2,448
Total Proposed Action Social Costs*	USEPA	1.5%	63	1,072	4,749

Note: Values are rounded to nearest $ million. Positive values represent costs while negative values represent benefits. Thus, negative values represent benefits to the proposed action, i.e., at the low activity level and a 2.5% discount rate for domestically produced or consumed energy, OCS oil and gas has lower social costs than the energy sources that are displaced under the proposed action. All other activity levels and discount rates result in positive values such that the proposed action results in higher social costs from GHG emissions associated with domestically produced or consumed energy.

* Total proposed action social costs are the social costs associated with the OCS oil and gas GHG emissions plus the reductions in social costs associated with displaced energy substitutes GHG emissions. These are the total social costs of GHG emissions attributable to the proposed action.

Comparisons of the total proposed action emissions (**Table H.2-8**) from domestically produced or consumed energy sources and their total proposed action social costs (**Table H.3-2**) reveal apparent contradictions, cases in which the proposed action leads to a decrease in total GHG emissions but an increase in social costs from those GHG emissions. These contradictions are due to the social cost per metric ton of CH_4 and N_2O relative to that of CO_2 being very different than the GWP of CH_4 and N_2O relative to CO_2.

When BOEM presents GHG emissions in **Table H.2-8**, it converts them to CO_2e using the USEPA's 100-year GWP value. As shown in **Table H.3-3**, these GWP ratios are not the same as the implied ratios of social costs for CH_4 and N_2O relative to those of CO_2 . The USEPA's 100-year GWP for CH_4 is 25 (meaning each ton of CH_4 has the same 100-year GWP as 25 metric tons of CO_2). However, using 2037 as an example year, the average USEPA social costs indicate that each ton of CH_4 has only 12 times the cost of a ton of CO_2. Because the relative social cost of CH_4 is so much lower than its 100-Year GWP, a given emission source having a higher proportion of CH_4 than its counterpart has the potential to result in incremental GHG emissions estimates that appear to contradict the incremental social cost estimates.

The apparent contradiction between the estimates of the total proposed action's social costs of GHG emissions versus the GHG volumes is further evidence of the closeness between the estimates for new OCS oil and gas leasing versus those of the substitute energy sources displaced by OCS oil and gas leasing. Changes in modeling or valuation assumptions, such as the GWP potential (in this case the 100-year GWP) and the SC-GHG's discount rate, can result in estimates that show slightly more versus slightly less GHG estimates from domestically produced or consumed energy due to new OCS leasing. When expressed in percentage terms as the percent of substitute energy sources' GHG emissions under the No Action Alternative, which are displaced by new OCS oil and gas leasing, the values are small. In other words, the estimates of total proposed action GHG emission volumes from domestically produced or consumed energy and the social costs of those GHG emissions are both close to those of the No Action Alternative baseline levels. However, when the shift in foreign GHG emissions and their social costs are considered, it is clear that new OCS oil and gas leasing results in an incremental increase in global GHG emissions and their social costs.

Table H.3-3. Scaling Methane (CH4) and Nitrous Oxide (N2O) Between Estimates of GHG Emissions and Their Social Costs.

Measurement Category	CO_2	CH_4	N_2O
Proportional GWP assigned to different GHGs (**Table H.2-8**)	1	25	298
USEPA's imputed proportional social cost of different GHGs relative to carbon dioxide for year 2037 at the 2.0% discount rate and average statistical damages*	1	12	294
USEPA's imputed proportional social cost of different GHGs relative to carbon dioxide for year 2037 at the 2.5% discount rate and average statistical damages**	1	15	315

* The imputed proportional social cost values use the USEPA estimates of the SC-GHG values for year 2037 from **Table H.3-1** such that for CO_2, $304/$304 = 1; for CH_4, $3,586/$304 = 12; and for N_2O, $89,327/$304 = 294.

** The imputed proportional social cost values use the USEPA estimates of the SC-GHG at the 2.5% discount rate and average statistical damages for year 2037 (https://www.boem.gov/environment/environmental-assessment/gulf-mexico-regional-ocs-oil-and-gas-programmatic, under the Supporting Information tab) such that for CO_2, $195/$195 = 1; for CH_4, $2,934/$195 = 15; and for N_2O, $61,313/$195 = 315. .

H.3.2.2 Shift in Foreign Oil Upstream and Downstream

BOEM followed the same process described above to calculate the social cost of emissions from increased foreign oil supply and consumption under the proposed action. **Table H.3-4** presents the social costs for the adjusted change in foreign oil's upstream related GHG emissions shown in **Table H.2-12**.

Table H.3-4. Social Cost of GHG Emissions from the Shift in Foreign Oil Supply Associated with the Proposed Action ($ millions).

SC-GHG Source	Discount Rate	Low Activity Level	Mid-Activity Level	High Activity Level
USEPA	2.5%	69	420	988
USEPA	2.0%	110	673	1,588
USEPA	1.5%	185	1,136	2,691

Note: Values are rounded to nearest $ million. These are the social costs associated with the GHG emissions from adjusted foreign oil supply presented in **Table H.2-12**.

Table H.3-5 shows the social costs associated with the GHG emissions shown in **Table H.2-14** estimated to result from the increase in GHG emissions resulting from increased foreign oil consumption.

Table H.3-5. Social Cost of GHG Emissions from the Shift in Foreign Oil Consumption Associated with the Proposed Action ($ millions).

SC-GHG Source	Discount Rate	Low Activity Level	Mid-Activity Level	High Activity Level
USEPA	2.5%	604	3,619	8,483
USEPA	2.0%	1,005	6,078	14,300

SC-GHG Source	Discount Rate	Low Activity Level	Mid-Activity Level	High Activity Level
USEPA	1.5%	1,750	10,671	25,190

Note: Values are rounded to nearest $ million. These are the social costs associated with the GHG emissions from adjusted foreign oil consumption presented in **Table H.2-13**.

There are many components of the foreign energy market that BOEM does not currently model and quantify. These components are thus not able to be monetized. BOEM acknowledges the limitations of its foreign GHG analysis next in **Section H.4** and provides a qualitative analysis where it is unable to provide a quantitative analysis.

H.4 Foreign Qualitative Life Cycle Greenhouse Gas Analysis

As shown in **Table H.2-12** and **Table H.2-14**, BOEM estimates emissions associated with the potential changes in foreign oil production and consumption resulting from the proposed action. However, BOEM recognizes that these changes are not a complete accounting of all potential changes in foreign markets and are not as comprehensive as the estimates of life cycle emissions from domestic production or consumption (**Table H.2-8**). BOEM recognizes that there are additional foreign energy market responses and impacts that cannot be quantified at this time (**Table H.2-1**); however, these are considered qualitatively in this section.

In developing the global life cycle GHG analysis, BOEM consulted with the contracted developer of MarketSim, Industrial Economics, Inc., to assist in refining and expanding its analysis. Through this expert review, Industrial Economics, Inc. extensively evaluated BOEM's approach to estimating the change in emissions associated with the shift in foreign energy consumption. However, given the model's current capabilities and limitations, Industrial Economics, Inc. acknowledged that MarketSim would not allow a complete estimation of foreign life cycle GHG emissions at that time. Since that initial consultation, BOEM has implemented Industrial Economics, Inc.'s intermediate solution to use the overseas oil production emissions factors that the OECM uses for oil imports to the U.S. and apply those emission factors to the shift in foreign oil production estimated by MarketSim. While BOEM has made some progress in the estimation of the proposed action's impact on foreign life cycle GHG emissions, there are still many life cycle stage components that BOEM is unable to quantify as explained below.

According to Industrial Economics, Inc., to provide a complete and quantitative estimate of the impact of OCS leasing on the global energy market and resulting GHG emissions, the model would need demand-driven and competition-driven substitution effects for all global major energy forms as well as upstream, midstream, and downstream emissions profiles for OCS oil and gas and domestic and foreign substitutes (Price 2021). To derive these substitution effects, the model requires a detailed global baseline energy forecast that includes multiple categories of supply, demand, and prices at a regional level. Industrial Economics, Inc. indicated it was unaware of any such existing forecasts with the required level of detail that have been published by a major organization. Industrial Economics, Inc. suggested that, in theory, BOEM could develop its own projections of foreign supply, demand,

and prices based on less detailed forecasts, but doing so would “require a number of assumptions that would introduce substantial uncertainty into MarketSim’s results” (Price 2021).

Currently, MarketSim estimates total non-U.S. supply and demand for oil. However, its specification of foreign oil demand does not include cross-price elasticities that would capture how foreign demand for oil changes in response to other energy prices. Similarly, the model does not capture how foreign demand for oil substitutes changes in response to oil prices. MarketSim also does not capture foreign production of gas and coal consumed outside the U.S. or foreign consumption of gas or coal produced outside the U.S. A comprehensive accounting of all these effects would require a substantial expansion of MarketSim in scope and complexity, as well as the development of baseline supply and demand projections beyond what is included in the Energy Information Administration’s Annual Energy Outlook.

Despite the extensive data requirements and limitations needed to estimate the proposed actions influence on foreign GHG emissions, BOEM determined that, for this analysis, BOEM could reasonably quantify the GHG emissions from foreign production and consumption of oil as presented in **Section H.2.5**. Meanwhile, BOEM continues to evaluate options to improve methodologies to estimate midstream emissions from foreign oil production, as well as those relating to the adjustment of foreign oil consumption, for use in future analyses.

Evaluating the foreign energy market qualitatively, the price decreases for oil under the proposed action would be felt beyond U.S. borders given that oil is a globally traded commodity. The displacements of substitute energy sources discussed earlier for the domestic energy market also occur in the foreign markets in response to the decrease in the price of oil. In this case, as the price of oil declines, increased consumption of oil would displace substitute energy sources such as coal, natural gas, biofuels, and others, but at different rates than within the U.S. depending on each country’s or region’s energy infrastructure and market.

H.4.1 Foreign Oil Life Cycle Change: Midstream Emissions

According to Industrial Economics, Inc., BOEM lacks the ability to estimate foreign oil midstream GHG emissions. First, BOEM does not have information on the volume of foreign midstream oil, and even if that were available, BOEM would be unable to estimate where changes in foreign oil midstream emissions would occur. BOEM needs this information to derive foreign midstream oil GHG emission factors. For the domestic markets and analysis, BOEM uses the USEPA’s midstream emissions inventory data to derive midstream emission factors for domestic oil. The GHG emissions associated with activities such as refining differ based on the quality of crude oil and the technological capabilities of different refining sectors within the foreign oil midstream, as the GHG emissions intensity of petroleum refining varies across countries. Thus, to be able to estimate foreign midstream emissions, BOEM requires projections of where oil is being refined. This requires knowledge and understanding of the total midstream GHG emissions and the volume of oil passing through the midstream. BOEM does not have a comparable data set for foreign markets.

Given these data limitations, BOEM considers these impacts qualitatively. If BOEM were to quantify foreign oil's midstream GHG emission by applying the same domestic refining GHG emissions data to the portion of global oil midstream not estimated in BOEM's domestic midstream analysis, it would represent an increase in global GHG emissions under the proposed action relative to the No Action Alternative. BOEM will continue to investigate potential updates to its methodology for future analyses.

H.4.2 Substitutes for Oil in Foreign Markets

To understand the complexities and limitations of estimating foreign energy market oil substitutes and their emissions, it is useful to provide context from BOEM's domestic analysis. The inputs for BOEM's domestic GHG model are based on the best available and most credible information. They are illustrative of the range and depth of data necessary to credibly conduct a full quantitative analysis of changes in foreign GHG emissions. BOEM's MarketSim model adopts assumptions from the Energy Information Administration (the primary Federal Government entity on energy statistics and analysis) and from economics literature cited in the model documentation. These assumptions help BOEM estimate where the likely substitute sources of oil and gas would come from (e.g., oil and gas production from State submerged lands, onshore domestic production, and international imports) and the other types of energy sources that would be utilized to balance demand and supply (i.e., coal, biofuels, nuclear, and renewable energy). Accurately estimating this mix of substitute energy sources is important because each substitute energy source has a different life cycle GHG emissions profile over the course of its production, transportation, refining, and/or consumption.

BOEM does not have complete data, like that of the Energy Information Administration for the U.S., for the rest of the world. As such, BOEM cannot evaluate the full set of substitutions that occur globally. To fully consider the substitution impact of the change in foreign oil consumption, BOEM would need information on the suite of energy sources that are displaced by the increased oil consumption and the supply and demand elasticities (including cross-price demand elasticities) associated with them. These displacement patterns vary throughout the world. BOEM and Industrial Economics, Inc. are currently unaware of data sets and model parameter estimates that would allow for modeling foreign energy market substitutions between oil, gas, coal, electricity, and reduced demand. And, if BOEM were able to develop the data set, development of a model capable of the required calculations of both domestic and foreign substitution effects would represent a significant challenge.

In the proposed action, the increase in oil consumption leads to an increase in total downstream GHG emissions because oil has a higher GHG intensity than most other energy sources. Accordingly, BOEM models the increase in foreign oil downstream emissions in **Table H.2-14**. However, were BOEM able to quantify energy substitution for oil in foreign markets, the total change in foreign downstream emissions would not be as large as that estimated in **Table H.2-14** given the unquantified emissions reductions associated with displaced substitute energy sources in foreign energy markets. In some areas, the additional oil consumption could replace coal, leading to a net reduction. While BOEM does not quantify displacement of substitute energy sources by oil in foreign energy markets under the proposed action, BOEM acknowledges that displacement of substitutes would certainly occur and that a portion of the increased emissions currently quantified would be mitigated by displaced GHG emissions from energy substitutes.

The same uncertainty exists in regard to estimating the displacement of GHG emissions from energy substitutes in the upstream and midstream. Industrial Economics, Inc. highlighted the complexities and wide range of data required to consider these substitutions. Industrial Economics, Inc. found that the change in GHG emissions associated with the full life cycle for all energy sources other than oil produced and consumed in foreign markets under the proposed action cannot be quantified without making significant assumptions and concluded that these effects are more appropriately addressed qualitatively.

Though oil is a global commodity, the regional nature of gas, coal, and electricity would require MarketSim to consider regional price differences and calculate regional equilibriums for these other fuels. Industrial Economics, Inc. characterized the necessary updates to create this global-regional analysis as "a major challenge" (Price 2021). Furthermore, regarding the necessary underlying data that would be required to support a model if built, Industrial Economics, Inc. stated the following:

> We are unaware of any existing forecasts published by EIA, the International Energy Agency, or other organizations that include this level of detail. In the absence of such a forecast, BOEM could develop its own based on less detailed forecasts that may be available, but this would likely require a number of assumptions that would introduce significant uncertainty into MarketSim*'s* results (Price 2021).

In summary, BOEM's domestic analysis estimates the GHG emissions associated with the full life cycle of energy substitutes displaced under the proposed action, but BOEM's foreign analysis is limited to quantifying the GHG emissions from changes in the foreign upstream and downstream of only oil under the proposed action. Missing from the foreign analysis are changes in foreign oil's midstream emissions and estimates of foreign energy market substitutions displaced in response to changes in oil prices. Because the quantifiable foreign analysis is not comprehensive, domestic production and consumption of GHG emissions are not directly comparable to the foreign estimates. Therefore, BOEM is not providing a combined quantitative estimate of domestic and foreign emissions because it would be potentially misleading to simply add them together.

BOEM is investigating methods to incorporate the foreign oil midstream GHG emissions and estimate the full life cycle GHG emissions of foreign energy substitutes displaced by oil. However, even with those additions, BOEM expects global GHG emissions would likely still be higher for the proposed action than the No Action Alternative baseline level. In the domestic analysis, emissions associated with the downstream consumption of oil far outweigh upstream and midstream emissions, the currently unquantified reductions (foreign oil substitutes) and additions (foreign oil midstream) would not be high enough to offset the increase in GHG emissions currently estimated from foreign oil's upstream and downstream. Moreover, downstream emissions account for the majority of the life cycle emissions, meaning most of the foreign GHG emissions have already been quantified in this analysis.

H.5 AREAS OF UNCERTAINTY IN MODELING INPUTS

BOEM's GHG analysis is subject to much uncertainty in several key variables. As described earlier, BOEM uses several models to estimate these impacts. Each of these models have different components, assumptions, or baseline data that, while based on the best available information, are uncertain. Differences in these variables can impact the analysis results. The key areas of uncertainty include the following:

- anticipated levels of activity and production, i.e.,
  - exploration and development activity per barrel of oil equivalent (BOE) of potential production and
  - the ratio of potential oil versus gas;
- model inputs including levels of elasticities and adjustment rates used;
- emission factors used for OCS production and substitute energy sources; and
- baseline energy projections.

The uncertainty related to elasticities and adjustment rates used and their impact on results is covered extensively in Appendix A of the MarketSim documentation (Industrial Economics Inc. 2023a). The uncertainty surrounding the social costs of potential GHG emissions are captured by the range of SC-GHG values published by the USEPA and discussed in **Section H.3**, which focuses on uncertainties not captured elsewhere in the analysis.

H.5.1 Activity and Production

The basis of BOEM's greenhouse gas analyses is the estimate of potential OCS production and associated activity. BOEM assumes that, if the proposed action is approved, industry would develop oil and gas resources in the Gulf of Mexico.

In addition to estimating the potential production that could result from a proposed action, BOEM estimates the associated activities and facilities required for the exploration and development of the potential production (i.e., number of wells drilled and operated; miles of pipelines laid; and platforms and other infrastructure installed, operated, and removed).

BOEM models potential OCS oil and natural gas activity and production under the proposed action at three different activity levels—low, mid-, and high—to account for uncertainties in market conditions, price volatility, consumer demand, and variable cost conditions. Potential production for the three activity levels is shown in **Table H.2-3**. Considerable uncertainty surrounds any future OCS production as this production is contingent on, in some cases, billions of dollars of investment risk. Additionally, the levels of exploration and development activity required to meet production within the exploration and development scenarios are uncertain. Both the activity and production projections within exploration and development are key contributors to the results of the GHG analyses given that each type of activity has a specific GHG emissions profile.

H.5.1.1 OCS Activity Per BOE of Production

Table 3.3-2 shows the range of activity levels (low to high). At the low activity level proposed action scenario (i.e., single lease sale), BOEM does not forecast new platforms would be installed and any new production would be exclusively using subsea tiebacks to existing platforms. This allows for substantial efficiency in terms of per-barrel GHG emissions as platforms have a higher total GHG emissions profile than subsea tiebacks. While the mid-activity and high activity scenarios include both platforms and subsea tiebacks, the mid-activity level has fewer platforms installed per barrel of production compared to the high activity level. The low and mid-activity levels also have fewer wells drilled per barrel of production than the high activity level. This variation in potential activity impacts upstream emissions and is a contributing factor to the total proposed action emissions differences between activity levels.

H.5.1.2 Relative Oil and Natural Gas Production

As described throughout BOEM's analyses, BOEM calculates the energy market substitutions that would be displaced by OCS production under the proposed action. The substitution rates are different for oil and natural gas because consumers and producers respond differently to changes in the price of oil and petroleum products (like gasoline) than they do to changes in the price of natural gas (primarily heating and electricity). For example, from the perspective of consumers, these differences in substitution patterns for oil versus gas may reflect differences in the availability of substitutes or differences in the extent to which different uses are discretionary (e.g., consuming energy for home heating is less discretionary than consuming gasoline for vacation transportation). BOEM's analyses generally involve scenarios that include both oil and natural gas. BOEM presents displacement rates as percentages representing the combined displacement rates of substitute energy sources by OCS oil and natural gas. The displacement rates for a given scenario depend on both the size of the scenario in terms of BOE produced and the ratio of oil to gas production in that scenario. As such, the ratio of oil to natural gas production is a large driver in the resulting displacement rates of energy market substitutes by OCS oil and natural gas. A different ratio of oil to natural gas production can impact the rates of displacement of energy market substitutes by OCS oil and natural gas, which in turn impact the GHG analysis and social cost calculations.

Table H.5-1 shows the displacement rates of energy substitutes for the three activity levels. For OCS oil production, a large percentage of the displacement impacts imports. For natural gas production, the largest displaced substitute energy source is onshore natural gas production. Natural gas production also has a much larger increased consumption as a result of the proposed action than oil (i.e., larger percentage not displaced). If actual production stemming from the proposed action resulted in higher levels of oil production and lower levels of natural gas production, the combined displacement rates would show higher levels of imports and lower levels of onshore production displaced. Such a scenario would also have a lower rate of increased energy demand (energy not displaced). Thus, a higher ratio of oil to natural gas would lead to greater reduction in GHG emissions from displaced energy substitutes and result in lower total proposed action emissions.

The difference in displacement rates of energy substitutes by OCS oil and natural gas is important to the analysis results given that OCS natural gas displacement favors substitute energy sources with lower or no GHG emissions when compared to energy sources displaced by OCS oil. BOEM's modeling is not able to consider whether any new electricity generation from wind, solar, nuclear, and hydroelectric sources require construction of new capacity as it may simply reflect increased generation of existing capacity. Therefore, BOEM does not associate any upstream, midstream, or downstream emissions with additional electricity from wind, solar, nuclear, and hydroelectric sources. Similarly, a portion of OCS oil and natural gas production does not displace any substitute energy sources at all. Rather, it represents the portion of potential OCS oil and natural gas production that would enable additional demand relative to the No Action Alternative baseline. A proposed action that assumes higher levels of potential OCS natural gas production would generally displace fewer GHG emitting substitute energy sources and result in higher total GHG emissions when compared to one with a lower ratio of natural gas to oil production. However, because OCS oil production largely displaces substitute oil imports, a proposed action with a high proportion of OCS oil production would have relatively fewer total GHG emissions attributed to it because the displaced oil imports have higher GHG emissions from upstream operations and transportation than OCS production. **Table H.5-2** shows the relative volume of oil versus natural gas production as a percent of total potential OCS production under the proposed action. The production percentages differ slightly due to the variation in the historical oil and gas volumes and producing gas to oil ratios. This activity forecast relies on different annual historical data for each scenario activity level.

Table H.5-1. OCS Oil Versus OCS Natural Gas Production Displacement Rates of Substitute Energy Sources under the Proposed Action.

Substitute Energy Source	OCS Oil Low Activity Level	OCS Gas Low Activity Level	Combined Low Activity Level	OCS Oil Mid-Activity Level	OCS Gas Mid-Activity Level	Combined Mid-Activity Level	OCS Oil High Activity Level	OCS Gas High Activity Level	Combined High Activity Level
Onshore Production	16.8%	63.8%	26.2%	16.7%	57.8%	23.6%	16.7%	54.5%	23.7%
Onshore Oil	15.8%	0.1%	12.8%	15.6%	0.7%	13.1%	15.4%	0.9%	12.7%
Onshore Gas	1.0%	63.7%	13.4%	1.2%	57.1%	10.5%	1.3%	53.6%	11.0%
Production from Existing State/Federal Offshore Leases	0.6%	0.2%	0.6%	0.6%	0.3%	0.5%	0.5%	0.2%	0.5%
Imports	65.9%	9.1%	54.4%	65.6%	8.9%	56.1%	65.5%	8.7%	54.9%
Oil Imports	65.8%	4.2%	53.4%	65.5%	3.9%	55.2%	65.4%	3.9%	53.9%
Gas Imports	0.1%	4.9%	1.0%	0.1%	4.9%	0.9%	0.1%	4.8%	1.0%
Coal	0.1%	0.2%	0.1%	0.1%	0.3%	0.1%	0.1%	0.3%	0.2%
Electricity from Sources Other than Coal, Oil, and Natural Gas*	0.9%	1.8%	1.1%	1.0%	2.4%	1.2%	1.0%	2.4%	1.3%
Other Energy Sources**	10.2%	0.1%	8.3%	10.0%	0.5%	8.4%	9.8%	0.6%	8.1%
Increased Energy Demand (energy not displaced)	5.4%	24.8%	9.3%	6.0%	29.9%	10.0%	6.3%	33.2%	11.4%

* Includes electricity from wind, solar, nuclear, and hydroelectric sources. BOEM does not associate any upstream, midstream, or downstream GHG emissions with these energy sources.

** Includes primarily natural gas liquids, with the balance from biofuels, refinery processing gain, product stock withdrawal, liquids from coal, and "other" natural gas not captured elsewhere. BOEM does not associate any upstream, midstream, or downstream GHG emissions with biofuels, which is a very small portion of "other energy sources."

Table H.5-2. OCS Oil vs OCS Natural Gas Percent of Potential Production.

OCS Fuel Produced	Low Activity Level	Mid-Activity Level	High Activity Level
Oil	80.1%	83.0%	81.0%
Natural Gas	19.9%	17.0%	19.0%

Note: The OCS natural gas is generally associated gas, meaning it is a by-product of targeted OCS oil extraction.

H.5.1.3 Impact on GHG Intensity and Results

The impact of the areas of uncertainty described above in **Section H.5.1.1** and **Section H.5.1.2** can be illustrated by looking at the GHG intensity of different components of the life cycle GHG emissions. The GHG intensity measures the amount of GHG emissions per unit of energy. **Table H.5-3** compares the GHG intensity values of the potential OCS oil and natural gas production to those of the energy sources it displaces. The GHG intensities in **Table H.5-3** are calculated by dividing the estimates of CO_2e emissions (**Tables H.2-5 and H.2-7**) by the potential OCS production (**Table H.2-3**).[16]

The first two rows of **Table H.5-3** show the upstream GHG intensities for OCS oil and gas production and those for the energy sources displaced respectively. These differences in GHG intensity values between the low, mid-, and high activity levels for the OCS oil and natural gas illustrate the impact different projections of exploration, development, and production activity within exploration and development scenario can have on results. The upstream GHG intensity values for OCS oil and natural gas of 1.8, 4.2, and 5.3 metric tons CO_2e (mtCO_2e) for the low, mid-, and high activity levels, respectively, are commensurate with the levels of activity per BOE within their exploration and development scenarios. In the upstream, displaced energy sources have fairly uniform GHG intensities, which allows the low and mid-activity levels to achieve slightly more negative total upstream emissions per barrel than the high activity level.

[16] The GHG intensities of the displaced energy sources found in the second and fourth rows of **Table H.5-3** are not truly the GHG intensities of those displaced energy sources, but rather their intensities relative to the volume of OCS production they are displaced by under the proposed action. This allows for direct comparison of the relative efficiency of the OCS oil and natural gas versus the energy it is displacing while also accounting for the increase in demand.

For the midstream and downstream, rows 4 and 5 of **Table H.5-3**, show the GHG intensity of the displaced energy sources between activity levels. As discussed in **Section H.5.1.2**, the displacement rates vary between the different activity levels. For example, the low activity level has a higher level of displacement for onshore natural gas than the mid-activity and high activity levels (shown in **Table H.5-1**).[17] Overall, the high activity level displaces GHG emitting substitute energy sources such as onshore oil and gas at a lower rate than the other two scenarios, meaning lower GHG intensity for substitutes relative to the low and mid-activity levels. This means that the midstream and downstream GHG emissions per BOE of potential OCS production under the proposed action are higher for the high activity level than for the low and mid-activity levels (**Table H.5-3**, row 6).

Thus, when viewed together, the upstream GHG intensities and the midstream and downstream GHG intensities illustrate how the domestic life cycle total GHG emissions at the high activity level could be positive while those at the low and mid-activity levels could be negative.

Table H.5-3. GHG Intensity Based on Domestic Life Cycle Activity under the Proposed Action (metric tons CO_2e per thousand BOE of potential OCS production).

Life Cycle Stage and Source of CO_2e	Low Activity Level	Mid-Activity Level	High Activity Level
(1) Upstream: OCS Oil & Gas	1.8	4.2	5.3
(2) Upstream: Displaced Energy Sources	-41.7	-42.2	-41.4
(3) Subtotal: Upstream	**-39.9**	**-38.0**	**-36.1**
(4) Mid- and Downstream: OCS Oil & Gas	321.6	322.0	321.7
(5) Mid- and Downstream: Displaced Energy Sources	-287.7	-285.0	-280.5
(6) Subtotal: Mid- and Downstream: Displaced Energy Sources	**33.9**	**37.0**	**41.3**
(7) Total: Life Cycle Domestically Produced or Consumed Energy	**-6.0**	**-1.0**	**5.2**

As described in **Section H.2.3**, BOEM's analysis shows that the life cycle GHG emissions attributable to OCS oil and gas is within 2 percent, plus or minus, of the GHG emissions from the energy sources displaced by that OCS oil and gas. E&D scenarios with different amounts of activity (e.g. more or fewer platforms installed) or different production assumptions (e.g. more or less natural

[17] In previous analyses, OCS natural gas displacement rates have generally been within 1% of each other across activity levels (e.g., imports are 9.1, 8.9., and 8.7 between the low, mid-, and high activity levels, respectively). That holds true in this analysis for the energy sources displaced by OCS oil and most energy sources displaced by natural gas. However, there is a 10% spread for the rate at which OCS natural gas displaces onshore natural gas between the low and high activity levels, with the onshore gas displacement rate falling from 63.7% under the low activity scenario to 53.6% under the high activity scenario. This is likely due to the large differences between activity levels' volumes of natural gas, the years over which those volumes occur, and how those volumes interact with the elasticities and adjustment rates for natural gas in MarketSim. This leads to a lower displacement of onshore production and higher rate of increased demand (less displaced energy) in the high activity level relative to the low activity level. This narrows the margin of mid- and downstream GHG emissions at the high activity level between OCS oil and gas versus those of displaced energy substitutes relative the margin at the low activity level.

gas relative to oil) would have different results, with some resulting in OCS oil and gas having higher GHG emissions and others showing displaced energy substitutes having higher GHG emissions.

H.5.2 Baseline Energy Projections: Supply, Demand, and Prices

The most fundamental source of uncertainty within BOEM's modeling is the composition of future energy needs and markets. As described in **Section H.2.2**, BOEM's models fundamentally rely on a baseline energy market projection (that includes current laws and policies) and assumptions of elasticity (how prices respond to changes in supply and demand and vice versa). The modeling baseline includes many of the provisions of the IRA which provide incentives toward a net-zero pathway in the U.S. However, as modeled by the Energy Information Administration in their 2023 AEO Reference Case, from which the modeling baseline is adapted, the IRA does not assume achievement of net-zero pathway. The specific provisions of the IRA that are included or excluded from the 2023 Reference Case may be found in Table 1 of their Appendix within the 2023 AEO Narrative (Energy Information Administration 2023)

The underlying modeling baseline and assumptions would be very different in a future that is successful in meeting net-zero goals. BOEM contracted a study that demonstrates the effect of different domestic net-zero pathways on the displacement rates of energy substitutes and subsequent estimates of potential OCS leasing on GHG emissions. The sensitivity tests highlight the importance of modeling assumptions and uncertainty in the parameters that likely affect the analyses. The testing showed that, under the domestic net-zero pathways, reduced energy demand and substitution to electricity make up a larger share of the overall substitution impact than under the default assumptions whereas substitution to fossil fuels makes up a smaller share of the substitution impact. Due to this change in the modeled substitution pattern, the net GHG emissions impact of the proposed action relative to the No Action Alternative baseline is higher under the domestic net-zero pathways than under the default assumptions. The results of this sensitivity analysis are presented and discussed in Appendix A.5 of the MarketSim documentation (Industrial Economics Inc. 2023a). The results are also summarized in Chapter 4 of the *Final Economic Analysis Methodology for the 2024-2029 National OCS Oil and Gas Leasing Program*) (BOEM 2023a).

H.6 CONCLUSION

BOEM's analysis of GHG life cycle emissions resulting from the proposed action indicates that domestic emissions from OCS oil and natural gas are similar to those resulting from displaced energy substitutes given that OCS production would replace large portions of domestic energy market substitutes. However, when considering the impact of changes in foreign oil production and consumption (**Table H.2-12** and **Table H.2-14**), global emissions increase in each activity level in the proposed action. Although BOEM's analysis includes quantification of GHG emissions from foreign oil production and consumption, lack of needed information currently precludes quantification of foreign oil's midstream GHG emissions and foreign substitutes' full life cycle GHG emissions. However, as discussed in **Section H.4**, such estimates would not be expected to change BOEM's conclusion that more global GHG emissions would occur under the proposed action.

Nonetheless, BOEM acknowledges the limitations and continues to explore ways to improve its methodology. BOEM will continue to review and refine the entire life cycle analysis as new data and methodologies become available. As demonstrated in **Section H.4**, BOEM developed the global component of this analysis using the most complete, recent information currently available with a sufficient level of detail for assessing these effects. This includes baseline projections of non-US energy consumption and production and non-US GHG emissions factors.

As shown in **Section H.5**, changes to underlying modeling assumptions and uncertainty in the parameters may impact BOEM's analyses. As demonstrated by the sensitivity tests, summarized in Chapter 4 of the *Final Economic Analysis Methodology for the 2024-2029 National OCS Oil and Gas Leasing Program*), greater progress towards the U.S.'s net-zero emissions goals would likely change the substitutions and lead to estimates of greater total GHG emissions under the proposed action than BOEM's current analyses, which is based on the 2023 Annual Energy Outlook reference case projections (BOEM 2023a). BOEM provides this information to underscore the uncertainty and importance of key variables in its analyses. Subject to available resources, BOEM continually seeks ways to improve its analysis, including the underlying areas of uncertainty within its analysis.

BOEM's quantitative and qualitative GHG analyses together represent the best available approach for comparison of GHG emissions from the proposed action and serve as a proxy for evaluating and comparing impacts to climate change relative to the No Action Alternative.

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APPENDIX I

KEYWORDS

I KEYWORDS

APPENDIX J

DECOMMISSIONING

J DECOMMISSIONING

J.1 INTRODUCTION

OCSLA and its implementing regulations, as well as the terms and conditions of the offshore oil and gas leases, rights-of-way (ROWs), and rights-of-use and easement (RUEs) granted by Interior and other applicable laws and regulations, require lessees, operation right holders, and holders of ROWs and RUEs to, among other things: (i) permanently plug all wells; (ii) remove all platforms and other facilities; (iii) decommission all pipelines; and (iv) clear the seafloor of all obstructions created by the lease, pipeline ROW, and RUE operations within one year after termination or when BSEE determines they no longer have future use (hearinafter, decommissioning activities). See 43 U.S.C. § 1334; 30 C.F.R. part 250, Subparts J and Q. The Bureau of Safety and Environmental Enforcement (BSEE) oversees the decommissioning and removal of infrastructure from the OCS.

In 2005, the Minerals Management Service (MMS, predecessor agency to the Bureau of Ocean Energy Management [BOEM] and BSEE) published the *Structure-Removal Operations on the Gulf of Mexico Outer Continental Shelf: Programmatic Environmental Assessment* (MMS 2005) (Decommissioning Programmatic EA). That evaluation encompasses all structure-removal operations (i.e., platform removals and well, pipeline, and mooring severances) currently under the regulatory authority of BSEE. The activities analyzed in the Decommissioning Programmatic EA include vessel and equipment mobilization, structure preparation, nonexplosive and explosive severance activities, post-severance lifting and salvage, and site-clearance verification. The impact-producing factors of structure removals considered in the Decommissioning Programmatic EA included seafloor disturbances, air emissions and water discharges, pressure and acoustic energy from explosive detonations, and space-use conflicts with other OCS users. Based on established significance criteria, the results of the impact analyses were that structure-removal activities were not expected to result in significant adverse impacts to any of the potentially affected resources. Potentially adverse but not significant impacts were identified for marine mammals and negligible to potentially adverse but not significant impacts were identified for sea turtles. In addition, no potentially significant impacts were identified for air and water quality; fish, benthic, and archaeological resources; or other OCS pipeline, navigation, and military uses. The mitigation measures included in the analysis were designed to reduce or negate potential impact producing factors related to (1) support vessel mobilization/demobilization, (2) progressive transport, (3) site-clearance trawling, and (4) explosive-severance activities. The Decommissioning Programmatic EA resulted in a Finding of No Significant Impact for all structure removal operations (i.e. platform removals and well, pipeline, and mooring severances).

Since the issuance of the 2005 Decommissioning Programmatic EA, MMS and later BSEE have managed well, pipeline, and structure decommissioning operations in accordance with the description of the proposed activities and impacts analysis as outlined in the EA. Additionally, all applications for infrastructure decommissionings undergo additional, tiered NEPA reviews prepared by BOEM for potential impacts and other compliance requirements, including Categorical Exclusion Reviews for lease-term pipeline decommissionings and ROW pipeline cessations, and Site-Specific EAs for structure decommissionings. For example, most Applications for Permit to Modify (APMs) proposing well decommissioning are managed under the Bureau of Safety and Environmental Enforcements's NEPA Compliance process, which relies upon a "conformance" clause in 30 CFR § 550.281(b) that ensures the activities proposed in the APM conform to those described in an associated and approved exploration plan, development and production plan, or development operations and coordination document. The NEPA review prepared for the associated plan can then be referenced by BSEE for application of a categorical exclusion (refer to 516DM15.4(C)(14)), unless an extraordinary circumstance exists, which would require a BOEM Supplemental EA (Site-Specific EA) for review and possible permit approval. Refer to Chapter 5.2.7.4 of the *Programmatic Description of the Potential Effects from Gulf of Mexico OCS Oil- and Gas-Related Activities: A Supporting Information Document* (GOM Oil and Gas SID) (BOEM 2023) for more information on permits and applications for structure removal and site clearance.

J.2 OCS Infrastructure and End of Term Decommissioning

J.2.1 Well Abandonments

When a company signs a lease for offshore oil or gas exploration or production, that initial agreement includes the requirement that all wells drilled under the lease would eventually be "decommissioned" or plugged and abandoned, which includes safely plugging the hole in the earth's crust and disposing of the equipment used to support the production. This process is critical for environmental protection after a well is drilled, utilized for production, and then plugged and sealed when the well is of no further use. Decommissioning regulations for wells are detailed in 30 CFR §§ 250.1710-1723. The regulations require operators to provide information sufficient for BSEE to determine whether the well decommissioning will be done successfully and will protect the environment and people using the waters around it. Under 30 CFR § 250.1710, operators must permanently plug all wells on a lease within 1 year after the lease terminates and verify site clearance within 60 days of well plugging under 30 CFR § 250.1740. BSEE may also order well decommissioning if the well poses a hazard or if the well is no longer useful for lease operations pursuant to 30 C.F.R. § 250.1711.

Well abandonment operations, both temporary and permanent, can occur at any well phase. Permanent abandonment operations are undertaken when a wellbore is of no further use to the operator (i.e., the well is a dry hole or the well's producible hydrocarbon resources have been depleted). From 2020-2024, permanent abandonment operations averaged 342 per year (**Table J-1**). During permanent abandonment, equipment is removed from the well, and specific intervals in the well that contain hydrocarbons are plugged with cement. A cement surface plug is also required for the abandoned well. The cement surface plug serves as the final isolation component between the wellbore and the environment. An operator may opt for temporary abandonment to (1) allow detailed analyses or additional delineation wells while deciding if a discovery is economically viable, (2) save the wellbore for a future sidetrack to a new geologic bottom-hole location, or (3) wait on design or construction of special production equipment or facilities. Abandoned wells are also sometimes converted into injection wells to store carbon dioxide, dispose of wastewater, enhance oil production and mining, or prevent saltwater intrusion. BOEM is currently funding a study to examine the potential existence and prevalence of leaking abandoned wells with the period of performance due to end on September 21, 2026.

Once the wellbore is secured and plugged and the operator moves to a permanent abandonment, the wellhead is required to be severed a minimum of 15 feet (ft) (5 meters [m]) below mudline (BML) in accordance with 30 CFR § 250.1715(a). The majority of BML cuts are accomplished using a mechanical or carbide cutter that is affixed to a drill string, which takes advantage of the rotary table of the drilling unit to power the unit and then lift the wellhead to the surface after the severance is complete. When wells are secured to a surface platform, the wells are often brought to temporary abandonment status and the associated conductor left until the platform is slatted to be decommissioned or a “slot recovery” is needed to remove the conductor and make space for side-track drilling operations. Similar to independent wellheads, the temporarily abandoned wells are required to have their conductors cut to 15 ft (5 m) BLM during the platform decommissioning and, once the conductors are cut and pulled, the well is given permanent abandonment status. However, if the platform jacket is accepted into the Rigs-to-Reefs Program to be reefed-in-place, BSEE does allow for the conductors to be cut at the height of jacket top.

Table J-1. Wells Decommissioned – Permanently Abandoned.

FY 2020	FY 2021	FY 2022	FY 2023	FY 2024	Annual Average
214	301	399	619	175	**342**

Under 30 CFR § 250.1716(b), operators can request that BSEE allow for a departure from the 15-ft (5-m) BLM requirement for wells in depths greater than 1,000 ft (305 m) since the Bureau has determined that there could be future utility in allowing the wellhead to remain above mudline (AML). An AML wellhead can provide for near-immediate reentry into the wellbore, should it be required for safety issues, relief wells, or other downhole management issues. Operators’ APMs requesting abandonment-in-place of the wellhead are required to provide a justification in alignment with the regulations, information on the type of wellhead, and the aerial and laterial measurements of the AML components. A site-specific NEPA review is conducted on each APM proposing wellhead abandonment in place to assess possible conflicts with deepwater commercial bottom trawling (generally limited to rock shrimp, royal red shrimp, and calico scallops) and military operations. The northern Gulf of Mexico OCS is used extensively by the U.S. military for aircraft, vessel, and weapons training exercises, which mostly occur on the surface and already require industry notification so not to interfere with their operations. However, exercises and deployments involving U.S. Navy submarines could still occur on the seabed; therefore, BSEE provides documentation to the U.S. Navy of the resultant abandonment, including location data, the height off the seabed, and make-up of the abandoned items. These types of abandonments occurred on average 31 times per year over 2020-2024 (**Table J-2**).

Table J-2. Wells in >1,000-ft Water Depth Abandoned-in-Place.

FY 2020	FY 2021	FY 2022	FY 2023	FY 2024	Annual Average
31	46	32	18	27	**31**

J.2.2 Structure Removals

During exploration, development, and production operations, the seafloor around activity sites within a proposed lease sale area becomes the repository of temporary and permanent equipment and structures (i.e. platforms, fixed structures, floating structures, moorings, and well heads). In compliance with Section 22 of BOEM's Oil and Gas Lease Form (BOEM-2005) and BSEE regulations (30 CFR § 250.1725 and 30 CFR § 250.1740), operators must remove seafloor obstructions from their leases within 1 year of lease termination or after a structure has been deemed obsolete or unusable and verify site clearance within 60 days after removal. Under 30 CFR § 250.1730, the BSEE Regional Supervisor may grant a departure from the requirement to remove the jacket assembly or other structure component if it is accepted by an approved, tate artificial reef program and meets the safety and environmental standards outlined in BSEE's Rigs-to-Reefs Program Policy (https://www.bsee.gov/sites/bsee.gov/files/rigs-to-reefs-program-policy.pdf).

Platforms are structures that allow the extraction, transfer, and processing of oil and natural gas, which is different from drilling rigs that "drill" a well to discover hydrocarbons and bring them to the surface for processing. Platforms generally consist of two parts for decommissioning purposes: the topside (the structure visible above the waterline) and the substructure (the parts between the surface and the seabed, or mudline). In most cases the topsides, which contain the operational components, are taken to shore for recycling or re-use. For fixed structures (e.g., jackets, compliant towers, and caissons), the substructure is required to be severed 15 ft (3 m) BML, then removed and brought to shore to sell as scrap for recycling, refurbished for installation at another location, or have components used as reef material. Floating facilities (e.g., tension-leg platforms (TLPs), Mini TLPs, Spars, semisubmersibles, and floating production storage and offloading vessels) have slightly different decommissioning processes; wherein their associated moorings (i.e., cables, chains, lines, etc.) are disconnected from their anchors or suction piles and removed. Depending on water depth, recovery issues, and potential conflicts with other user groups, operators can request that the anchors/suction piles remain in-place after decommissioning under 30 CFR § 250.1728(b). Research by Kaiser and Narra (2018) suggests that decommissioning activity fluctuates year-to-year, and from 2007 through 2017 between 100 and 290 structures were decommissioned annually in water depths less than 400 ft (122 m). Over the past decade, the offshore energy industry has averaged 127 platform removals per year with fewer (90 removals per year) happening over the last 5 years (**Table J-3**). This level of decommissioning activity in water depths less than 400 ft (122 m) is likely the result of aging infrastructure, maturity of producing properties in the region, sustained low oil and gas prices, and regulatory conditions and oversight. From 1989 to 2017, a total of 23 structures in water depths greater than 400 ft (122 m) were decommissioned (Kaiser and Narra 2018). This level of decommissioning activity in water depths greater than 400 ft (122 m) is due to several factors, but the most obvious are the small number of structures installed annually, as well as the significant capital expenditures and planning required in development and execution of decommissioning operations. Decommissioning activities in water depths greater than 400 ft (122 m) are expected in the years ahead unless alternative uses for structures are found. Approximately 1,350 platforms (i.e., caissons, well-protector structures, and jacketed and floating facilities) remain on the OCS, with more than 60 percent of these facilities being more than 25 years old.

Table J-3. Structure Decommissionings – Explosive Severance versus Mechanical Severance.

Year	FY2020	FY2021	FY2022	FY2023	FY2024	Annual Average
Explosive	4	16	22	19	5	**13**
Mechanical (non-explosive)	31	53	77	186	38	**77**
Total	**35**	**69**	**99**	**205**	**43**	**90**

Various severing devices and methods are used to cut structural targets during decommissioning activities. The structures are generally grouped into two main categories depending upon their relationship to the platform/facilities (i.e., piles, jackets, caissons, templates, mooring devices, etc.) or the well (i.e., wellheads, casings, casing stubs, etc.). The methodologies and tools for removal operations are generally grouped and classified as either nonexplosive or explosive. Operators and contractors decide which severing tool to use based on the consideration of the target size and type, water depth, economics, environmental concerns, tool availability, and weather conditions. Explosive and nonexplosive severing tools are used on the OCS for a wide array of structure and well decommissioning targets in all water depths, and they can be deployed and operated by divers, remotely operated vehicles, or from the surface. Many decommissions use both explosive and nonexplosive technologies (prearranged or as a backup method). Common nonexplosive severing tools consist of abrasive cutters (e.g., sand cutters and abrasive water jets), mechanical (carbide) cutters, diver cutting (e.g., underwater arc cutters and the oxyacetylene/oxy-hydrogen torches), and diamond wire cutters. There are several types of explosive severing: (1) mechanical distortion (ripping), (2) high-velocity jet cutting, and (3) fracturing or "spalling." From 2013-2022, approximately 65 percent of future platform removal permit applications requested authorization for the use of explosive severing methods, often as a back-up cutter when other nonexplosive methodologies prove unsuccessful (Welsch, official communication, 2023). However, from 2020-2024,only 15 percent of removals used explosives (**Table J-3**), and BOEM expects this trend to continue.

After all decommissioning work is completed and the structure is salvaged, operators are required to perform site-clearance verification (SCV) work to ensure that the seafloor is clear of all obstructions created during their lease, ROW, or RUE operations, and is restored to prelease conditions in compliance with 30 CFR § 250.1703(e). Based upon requirements found in Subpart Q of the OCSLA regulations (30 CFR §§ 250.1740-1743), operators are required to trawl all locations in less than 300 ft (91 m) with nets similar to those used by commercial fishermen, since they may be most impacted by OCS debris. In deeper water depths, in areas near where archaeological or biological resources are present, and when certain seafloor conditions make trawling activities hazardous, operators may also request SCV using high-resolution sonar or ROV surveys to detect debris and/or obstructions and help facilitate its removal.

The SCV regulations found in 30 CFR § 250.1741 outline minimal clearance areas associated with the various infrastructure types that represent locations on the seafloor where debris would likely exist during normal operations. Facilities damaged or toppled during storm events often have debris displaced far outside the minimal areas, and BSEE may require larger SCV coverage and/or surveying to ensure that all the material is retrieved and the potential for space-use conflicts is reduced.

J.2.3 Pipelines and Other Appurtenances

There is a range of offshore infrastructure installed for hydrocarbon production, including pipelines, bottom-fixed and floating platforms, caissons, well protectors, casing, wellheads, flowlines and risers, manifolds, jumpers, flowline support sleds, subsea systems, and conductors. Federal regulations require that offshore leases be cleared of all structures within 1 year after production on the lease ceases. While production structures are typically removed, many appurtenances and certain types of equipment (e.g., subsea systems, pipelines, umbilical lines, etc.) might not be removed from the seafloor (i.e., decommissioned in place), as is allowed under certain conditions in 30 CFR Part 250. For appurtenances and equipment left on the seafloor, BOEM, on behalf of BSEE (the decisionmaker), performs additional NEPA review as part of the decommissioning application(refer to Chapter 5 of the GOM Oil and Gas SID). Since the 1940s, the offshore oil and gas industry has installed approximately 40,000 miles (mi) (64,374 kilometers [km]) of oil and gas pipelines in Federal offshore waters of the GOM; approximately 8,600 mi (13,840 km) of those pipelines are active as of 2021. From 2009 to 2019, roughly 11,500 mi (18,507 km) of pipeline were decommissioned; approximately 98 percent of which was decommissioned in place (11,270 mi; 18,137 km) in accordance with 30 CFR § 250.1006, while the other 2 percent was removed (230 mi; 370 km). More recently and in terms of pipeline segments, from 2020 to 2024 pipeline segments were removed about 19 percent of the time and decommissioned in place about 81 percent of the time on average annually (**Table J-4**). The decrease in DIP percentage is likely due to increased removals in blocks containing SSRAs. Generally, pipelines must be removed from the seafloor; however, under existing regulations, 30 CFR § 250.1750, pipelines may be decommissioned in place when the BSEE Regional Supervisor determines that the pipeline does not constitute a hazard (obstruction) to navigation and commercial fishing operations, unduly interfere with other uses of the OCS, or have adverse environmental effects.

Table J-4. Pipeline Decommissionings – Segments Removed versus Abandoned in Place.

Year	FY 2020	FY 2021	FY 2022	FY 2023	FY 2024	Annual Average
Removed	24	26	25	32	11	**24**
Abandoned in Place	66	96	157	177	30	**105**

At the end of its useful life an offshore pipeline may be decommissioned in place, which normally involves cleaning the line by pigging (procedure to clear residual hydrocarbon) and flushing or flushing alone (with approval by BSEE's Regional Field Operations Regional Supervisor), cutting the pipeline endpoints, and then plugging and burying each endpoint below the seabed or covering the endpoints with a concrete mattress. When decommissioning- or other-related severing occurs, marine conditions and water depths often do not allow for the presence of divers; therefore, in many instances, external shaped charges and nonexplosive tools such as hydraulic shears, guillotine saws, and diamond wire cutters can be deployed from ROVs. Once the operator completes their severing activities, the structures must be removed from the seabed and transported to its final destination (i.e., salvage yard, alternative location, reef site, etc.). After all decommissioning work is completed and the structure is salvaged, operators are required to perform site-clearance work based upon requirements found in Subpart Q of the OCSLA regulations (30 CFR §§ 250.1740 to 250.1743).

The regulations governing Pipelines and Pipeline Rights-of-Way, are under Subpart J at 30 CFR §§ 250.1000-1019 (30 CFR part 250). In March 2021, the Government Accountability Office (GAO) published a report, "Offshore Oil and Gas: Updated Regulations Needed to Improve Pipeline Oversight and Decommissioning" (GAO 2021) that determined that BSEE's pipeline regulations were out of date and recommended that BSEE update 30 CFR part 250, Subpart J. In response, BSEE is drafting a proposed rule revising 30 CFR part 250, Subpart J to improve pipeline safety, environmental protection, and equipment reliability.

J.3 Idle Infrastructure Decommissioning

In addition to the decommissioning requirements noted above, inactive and nonessential infrastructure can remains on active OCS leases, ROWs, and RUEs, even when these items are "*no longer useful for operations*," as outlined in 30 CFR § 250.1703. This "Idle Iron," as it is termed, can include wells, structures, and pipelines that pose potential and unnecessary safety and environmental impacts to personnel and sensitive OCS resources, especially if components are allowed to deteriorate or become damaged or toppled during storm events.

Deteriorated facilities increase safety risks to industry personnel and even BSEE inspectors due to degraded boat landings, gratings, ladder wells, and handrails needed to access and traverse platforms. Firefighting and other safety equipment on idle facilities may not function when needed, and the risk of vessel collisions may also increase if lighting and other navigational aids are not maintained on idle platforms. Similarly, deteriorated tanks, piping, storage units, and other equipment may lead to a loss of integrity and leaking of hydrocarbons and other contaminants into coastal and marine waters, which may lead to acute and chronic impacts to seabirds, fish, and other marine protected species in the vicinity of the structure.

Storm-toppled wells and facilities may introduce broad environmental hazards due to hydrocarbon and contaminant leaks from the damaged wells and submerged tanks, piping, and equipment. There are also increased safety risks due to potential impacts to other OCS users from unmarked seabed obstructions and the need for extremely dangerous diving and lifting operations required to gain access to the well conductors for plugging and abandoning activities and to remove the toppled platform decks and jackets, production equipment, and extensive debris fields. Storm systems also have the capacity to unbury and shift pipelines dozens to hundreds of feet outside of their prior routes and several feet up into the water column, making them more susceptible to snagging by anchored vessels and commercial trawlers. These snagged pipelines result in unnecessary space-use conflicts and may lead to potential hydrocarbon leaks and injury to crews.

The GAO, in its January 2024 report "Interior Needs to Improve Decommissioning Enforcement and Mitigate Related Risks" (GAO 2024) noted that delayed decommissioning increases environmental, safety, and financial risks. The GAO found that the Department of the Interior (DOI) could better enforce decommissioning deadlines and mitigate the safety, environmental, and financial risks that unmet decommissioning obligations pose by ensuring BSEE and BOEM prioritize completing planned actions. The GAO made four recommendations to DOI to strengthen BSEE and BOEM's decommissioning oversight and enforcement: (1) strengthen BSEE's approach to proactively overseeing and enforcing decommissioning deadlines; (2) complete planned actions to identify, propose, finalize, and fully implement changes to decommissioning regulations and guidance; (3) complete planned actions to further develop, finalize, and fully implement changes to financial assurance regulations and procedures that reduce financial risks; and (4) complete planned actions to assess and revise qualification procedures to address decommissioning capacity and compliance history. The DOI has agreed with all recommendations made by these GAO reports and is currently working towards their implementation.

J.3.1 Defining Idle Infrastructure Qualifications – 30 CFR § 250.1703

Following the 2005 and 2008 storm seasons, MMS identified hundreds of idle wells and platforms that were damaged and/or toppled, many of which led to unnecessary safety and environmental impacts similar to those noted in **Section J.3**. In addition to the substantially higher costs associated with remediation and removal work of toppled facilities, the limited decommissioning support crews, equipment, and vessels required to address the idle infrastructure put an even greater strain on recovery needs for critical, active facilities having to return to service. To provide additional guidance to lessees and ROW/RUE holders on their decommissioning obligations for idle infrastructure, BSEE developed NTL No. 2010-G05 and then NTL No. 2018-G03 to clarify when the Bureau may deem infrastructure "no longer useful for operations" and "not capable of oil, gas, and sulphur production in paying quantities" and the associated timeframes for decommissioning work since the regulations do not provide timeframes. The NTL also provides guidance for companies that believe their infrastructure may be useful for future operations or capable of production in paying quantities, which includes the submittal of supporting documentation for review and concurrence. Even when BSEE concurs that a well may be useful and is capable of producing in paying quantities, companies are informed that they may still be required to ensure the well is secured and that producing zones are isolated to prevent potential safety and environmental impacts.

J.3.2 Decommissioning Compliance and Enforcement Framework for Idle Infrastructure

In April 2023, BSEE also promulgated new regulations under 30 CFR § 250.1708 to outline the Bureau's enforcement framework for predecessors to complete decommissioning. This enforcement approach is broken into three timeframes:

- *Within 30 days*, predecessors are required to begin maintaining and monitoring facilities, wells, and pipelines identified by BSEE in accordance with all applicable regulatory requirements, which include, but are not limited to, testing safety valves and sensors, draining vessels, and performing pollution inspections.

- *Within 90 days*, predecessors must designate a single entity to serve as operator or agency to oversee the decommissioning operations.
- *Within 150 days*, predecessors are required to have their designated entity/operator submit a Decommissioning Plan to BSEE for review and approval, which includes the scope of work and a reasonable decommissioning schedule for all wells, platforms and other facilities, pipelines, and site clearance verification.

Once the Decommissioning Plan is approved, the designated predecessor is required to perform the decommissioning work in compliance with the specified schedules and procedures. If any of the requisite items are not submitted and managed within the three specified timeframes and/or if decommissioning activities are not conducted according to the Decommissioning Plan, then BSEE has the ability to issue an Incident of Noncompliance (INC) outlining corrective actions and/or move towards other enforcement actions, including a civil penalty (CP).

J.3.3 Idle Infrastructure Inspections and Monitoring

As of September 2024, there are over 950 idle wells and 175 idle facilities identified by BSEE on the Gulf of Mexico OCS. Safety and environmental-compliance inspections are maintained on idle infrastructure, prior to and after issuance of the Bureau orders noted above, in accordance with field compliance priorities outlined in the Gulf of Mexico Region’s Annual Inspection Plan. The focus of the safety and environmental-compliance inspection remains the same as that for an active facility and is variable only with regards to the existing wells and equipment. Despite an associated Decommissioning Plan and approved schedule, should an inspection of idle infrastructure identify any component that poses a threat of serious, irreparable, or immediate harm to human health and safety or the environment and/or violates an associated law, regulation, or other conditional requirement, BSEE can issue a Bureau order under 30 CFR § 250.107(d) for the “shut-in” of the operations or facility and require immediate remediation, decommissioning, and removal. Failure to comply with a shut-in order can result in an INC, CP, and/or disqualification as an OCS operator.

J.4 Refurbishment/Reuse, Scrapping, and Disposal Streams

Most of the material that is decommissioned and removed from the OCS has the potential for continued use following refurbishment or has value in the form of scrap slated for recycling. Decommissioned well components, pipeline infrastructure (e.g., PLEMs, PLETs, valving, and couplers), and platform equipment that can be refurbished and reused (in part or as a complete unit) are taken to their associated manufacturing or assembly companies, once brought back to shore. The equipment is then sandblasted, stripped, or treated for surface corrosion and then decontaminated in the yard with steam and/or solvents according to State permitting prior to any expendable replacements and recalibration. Similarly, deck assemblies and jackets from decommissioned platforms that are still within their design life are returned to fabrication yards for repairs and refurbishment work to allow for their use at alternative State water and OCS sites. Structural components are stripped to allow for flooded-member testing and x-ray work on critical welds. Once the assessments are complete and the items repaired and retested, they are treated and coated similar to that of new structural items and prepared for return to service.

Well, pipeline, and structure equipment and other components removed from the OCS with no future utility are most often transported to specialized fabrication and/or scrap yards that can manage any requisite decontamination (as noted above with steam and solvents) and the additional processing needed to allow for the scrapping process to begin. The steel used in most offshore equipment and structural components is highly recyclable and can help recoup some costs associated with the decommissioning process. Most of the scrap yards are located along the Gulf Coast of Louisiana and Texas in industrial areas that also support offshore oil and gas operations. These areas are generally found in Venice, New Orleans, Houma, Morgan City, New Iberia, and Cameron, Louisiana and in Galveston, Houston, Corpus Christi, and Brownsville, Texas. Once decontaminated, sorted, and sized, the material is loaded onto trucks, train cars, and/or barges for transport to steel recycling centers that further sort the items by alloy types before being melted in electric arc furnaces along with other chemicals and material to allow for purification and reforming into new steel.

A much smaller amount of non-metal debris that primarily consist of wooden pallets, plastics, ropes and lines, tires (used for boat-landing bumpers), and minor equipment items that cannot be recycled are also collected during facility decommissionings and as a result of SCV efforts. Once brought to shore, the material is transferred to dockside dumpsters provided by the operator; in most cases, these are managed by contractors to oversee the final transport to landfills and waste processing centers and coordinate the necessary State and local permitting.

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