OCS Study
BOEM 2021-043

# National Environmental Policy Act Documentation for Impact-Producing Factors in the Offshore Wind Cumulative Impacts Scenario on the South Atlantic Outer Continental Shelf

**U.S. Department of the Interior**
**Bureau of Ocean Energy Management**
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Avanti Corporation
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## ABOUT THE COVER

Photo: Tybee Island Pier, Tybee Island, GA. Photo credit: TJ Boyle Associates LLC

# EXECUTIVE SUMMARY

This document is intended to be a living document that will be revised and adapted through its use to include updated information and to incorporate new activities or effects not currently identified.

The Council on Environmental Quality (CEQ) regulations for implementing the National Environmental Policy Act (NEPA) define cumulative effects as, "the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions." (40 CFR §1508.7) Accordingly, NEPA requires agencies to consider not only the incremental direct and indirect effects of a particular action on environmental resources, but also the cumulative effects of the action that occur in combination with other actions. The purpose of the cumulative effects analysis is to ensure that the decision maker fully considers the consequences of the proposed action (CEQ 1997).

CEQ's guidance for evaluating cumulative effects as part of NEPA analyses specifies the need to include all relevant past, present, and reasonably foreseeable future actions and to focus on truly meaningful effects. Agencies are charged with developing action- or activity-specific cumulative impacts scenarios in accordance with this general guidance. Considering expected growth in renewable energy renewal offshore North Carolina to northern Florida, the purpose of this document is to establish a common cumulative impacts scenario framework for use in NEPA analyses for offshore wind activities on the South Atlantic Outer Continental Shelf (OCS). This will enable efficient and effective identification of relevant actions for the cumulative effects analyses, and the development of consistent, succinct NEPA documents that demonstrate sound logic for cumulative effects findings.

This document provides the following guidance to establish cumulative impact scenarios for future renewable energy projects on the South Atlantic OCS:

- **Identifies the important cause-and-effect relationships between renewable energy projects and potentially affected resources**. BOEM refers to these relationships in terms of the Impact Producing Factors (IPFs) generated by these activities that directly or indirectly affect physical, biological, economic, or cultural resources. Based on these IPFs, this document identifies the relevant affected resources that should be considered in the cumulative impacts analysis.
- **Identifies the types of actions and activities to include in the cumulative impacts scenario**. This document identifies multiple types of actions and activities (including federal, non-federal and private actions) that may affect the same physical, biological, economic, or cultural resources as the renewable energy actions that should therefore be considered in terms of the collective effects. These "cumulative actions and activities" may generate the same IPFs as renewable energy or affect the same resources in other ways (i.e., via different IPFs).
- **Identifies past, present, and reasonably foreseeable actions and activities in the South Atlantic OCS to consider in future NEPA cumulative impact scenarios**. Chapter 3 of this document provides activity-specific overviews of activity levels and locations, presenting information in tables and maps where possible. This information may be used as a starting point for cumulative effects analyses for future renewable energy projects. This information reflects the state of knowledge as of March 2020; future analyses will therefore require some additional research to ensure the cumulative impacts scenario is current.
- **Provides guidance on and information sources for identifying relevant past, present, and reasonably foreseeable actions for each action/activity**. Cumulative impact scenarios for renewable energy projects will be location-specific and will therefore require some additional research regarding the specific actions and activities to be included (e.g., amount of vessel traffic or extent of dredging and presence of disposal sites). Chapter 2 of this document defines resource-specific spatial boundaries that identify the area over which relevant actions and

activities may affect a given resource. The action and activity-specific sections of Chapter 3 then direct analysts to the best available information sources to identify and quantify the relevant actions and activities.

Chapter 1 of this document provides an overview of the categories of activities and affected resources relevant to cumulative impacts scenarios of renewable energy projects. Chapter 2 describes the logic for the guidance regarding which activities to include in future cumulative impacts scenarios. Chapter 3 links actions and activities to IPFs (which define cause-and-effect relationships between actions/activities and environmental resources). Chapter 4 links the IPFs to affected resources. While the document attempts to describe the full suite of potentially relevant activities, IPFs, and resources likely to be appropriate for NEPA reviews of offshore wind energy projects, it may not match every future project. As such, site-specific conditions need to be considered for each evaluation.

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## ACRONYMS

| | |
|---|---|
| **AIS** | Automatic Identification System |
| **AOI** | Area of Interest |
| **ASAP** | Atlantic Sand Assessment Project |
| **BOEM** | Bureau of Ocean Energy Management |
| **BTS** | Bureau of Transportation Statistics |
| **BTTS** | Bourne Tidal Test Site |
| **CFR** | Code of Federal Regulations |
| **CLIA** | Cruise Lines International Association |
| **COP** | Construction and Operations Plan |
| **CVOW** | Coastal Virginia Offshore Wind |
| **CZMA** | Coastal Zone Management Act |
| **DoD** | Department of Defense |
| **EA** | Environmental Assessment |
| **EFH** | Essential Fish Habitat |
| **EIS** | Environmental Impact Statement |
| **EM** | Electromagnetic |
| **EMF** | Electromagnetic Field |
| **EPA** | Environmental Protection Agency |
| **GSFC** | Goddard Space Flight Center |
| **G&G** | Geological & Geophysical |
| **HRG** | High-resolution Geophysical |
| **HVDC** | High voltage direct current |
| **IPCC** | Intergovernmental Panel on Climate Change |
| **IPF** | Impact-producing Factor |
| **LME** | Large Marine Ecosystem |
| **LNG** | Liquefied Natural Gas |
| **MARAD** | Maritime Administration |
| **MMP** | Marine Minerals Program |
| **MPRSA** | Marine Protection, Research, and Sanctuaries Act |
| **MW** | Megawatt |
| **NASA** | National Aeronautics and Space Administration |
| **NASCA** | North American Submarine Cable Association |
| **NEPA** | National Environmental Policy Act |
| **NHPA** | National Historic Preservation Act |
| **NMFS** | National Marine Fisheries Service |
| **NPDES** | National Pollutant and Discharge Elimination System |
| **NOAA** | National Oceanic and Atmospheric Administration |
| **O&M** | Operation and Maintenance |
| **OCS** | Outer Continental Shelf |
| **OCSLA** | Outer Continental Shelf Lands Act |
| **OPAREA** | Operating Area |
| **OREC** | Offshore Renewable Energy Credit |
| **OWF** | Offshore Wind Farm |
| **PPA** | Power Purchase Agreement |
| **SAP** | Site Assessment Plan |
| **SHPO** | State Historical Preservation Office |
| **SML** | Surface Mixed Layer |
| **TSHD** | Trailing Suction Hopper Dredger |
| **TSS** | Traffic Separation Scheme |

| | |
|---|---|
| **USACE** | United States Army Corps of Engineers |
| **USCG** | United States Coast Guard |
| **WEA** | Wind Energy Area |
| **WLA** | Wind Lease Area |
| **WNW** | West-Northwest |
| **WTG** | Wind Turbine Generator |

# 1. INTRODUCTION

This report is intended to be a living document that will be revised and adapted to include updated information and to incorporate new activities or effects not currently identified. This document is to be used with the companion document prepared for the North Atlantic (BOEM 2019a).

The Bureau of Ocean Energy Management (BOEM) anticipates having to prepare environmental assessments (EAs) and environmental impact statements (EISs) for renewable energy leasing and projects proposed in the South Atlantic. In this document the Area of Interest (AOI) covers the Outer Continental Shelf (OCS) offshore North Carolina to Florida, ending north of approximately Canaveral Florida. As a point of clarification, BOEM's OCS Mid Atlantic Planning Area extends to the southern border of North Carolina while its South Atlantic Planning Area covers the OCS from the northern border of South Carolina to approximately the northern half of Florida's Atlantic coast. The charge of this document to discuss the "South Atlantic," referred to in this document as the South Atlantic AOI, that covers the OCS area offshore North Carolina to northern Florida.

The objective of this project is to provide supporting documentation that can be used in multiple EAs and EISs considering wind energy leasing, construction and operations plans (COPs), and general activities plans (GAPs) in the South Atlantic. To improve efficiency and consistency amongst these documents, BOEM has identified certain sections that will be similar across EAs and EISs. One section so identified is the cumulative impacts scenario.

Several activities were performed to develop the cumulative impacts scenario:

- Identification and descriptions of impact-producing factors (IPFs) associated with past, present, and reasonably foreseeable future actions occurring within the area of interest (AOI) with which offshore wind energy project IPFs could potentially have overlapping impacts.
- Development of the methodology for determining which past, present, and reasonably foreseeable future actions and their associated IPFs and activities should be included in the cumulative impacts scenario. The methodology addresses:
    - criteria for including future actions (e.g., what makes them reasonably foreseeable);
    - determinations identifying other past, present, and reasonably foreseeable future actions that BOEM's future proposed actions could add to, subtract from, or synergistically interact with; and
    - temporal and spatial bounds applicable to each affected resource.

Categories of cumulative activities and other relevant factors addressed in this document include:

- other wind energy development activities such as site characterization surveys; site assessment activities; and construction, operation, and decommissioning of wind energy facilities;
- tidal/wave/hydrokinetic energy projects;
- marine minerals extraction;
- dredged material ocean disposal;
- military ranges and civilian space program uses;
- marine transportation, navigation, and traffic;
- commercial and recreational fishing;
- climate change;
- oil and gas surveys and extraction;
- submarine transmission lines, pipelines, cables, and infrastructure (e.g., telecommunications); and
- land use and coastal infrastructure.

Although climate change is not an action, its reach touches nearly all actions included above. Climate change is altering the baseline against which the impacts of human actions are measured. Climate change is included in this list as an action and has IPFs that interact with those of Outer Continental Shelf (OCS) wind development to potentially affect resources discussed in this document. Climate change is described as an action in Chapter 3 and its interactions and impacts are discussed in Chapter 4.

The IPFs of these cumulative scenario activities were identified. The set of IPFs specific to each of these cumulative scenario activities that could interact with the same IPFs resulting from offshore wind development and could potentially affect physical, biological, or socioeconomic resources are the focus of this document. These resources include:

**Physical Resources**

- Acoustic Environment
- Air Quality
- Minerals Resources
- Water Quality

**Biological Resources**

- Birds and Bats
- Coastal Habitats
- Benthic Communities
- Fish; Essential Fish Habitat (EFH); Threatened and Endangered Fish (T&E Fish)
- Marine Mammals
- Sea Turtles
- Areas of Special Concern

**Socioeconomic and Cultural Resources**

- Demographics, Employment, Economic Resources, and Environmental Justice
- Cultural and Historic Resources
- Visual Resources
- Tourism and Recreation
- Commercial and Recreational Fishing
- Land Use and Infrastructure
- Military Range Complexes and Civilian Space Program Uses
- Marine Transportation, Navigation, and Traffic
- Energy Production and Distribution

# 2. METHODOLOGY FOR SELECTING PAST, PRESENT, AND REASONABLY FORESEEABLE FUTURE ACTIVITIES

## 2.1 DEFINITIONS OF KEY TERMS

**Cumulative Actions and Activities**: Actions and activities relevant to this report include industrial or commercial undertakings that use or exploit natural or social resources and which result in impact-producing factors (IPFs). A particular action or activity may result in multiple IPFs.

**Impact Producing Factors (IPF)**: IPFs identify the cause-and-effect relationships between actions (e.g., a wind energy project) and relevant physical, biological, economic, or cultural resources. They define the particular way(s) in which an action or activity affects a given resource. It is common that multiple IPFs affect the same resource.

**Impacts**: Impacts are the positive or negative effects that result from the interaction between a resource and an IPF.

**Resources**: The physical, biological, economic, or cultural resources affected by IPFs that result from cumulative actions and activities.

## 2.2 CONCEPTUAL FRAMEWORK OF ACTIONS, IPFS, AND RESOURCE INTERACTIONS

The framework for the presentation of the information provided in Chapters 3 and 4 is provided below to guide the reader in understanding the relationships and interactions described in these chapters. The conceptual framework illustrates the integration of impacts from offshore wind energy development IPFs into the totality of stressors that a resource faces from multiple actions and related IPFs.

The relationship between relevant cumulative actions, IPFs that result from these actions, and resources that are affected, is complex. This is because actions typically result in multiple IPFs, and multiple IPFs may affect the same resource. This report separates these concepts into two descriptive chapters: Chapter 3 describes relevant past, present, and reasonably foreseeable future actions and the IPFs that result from those actions. Chapter 4 describes the resources that may be affected by offshore wind energy projects, the IPFs that affect those resources, and the cumulative actions and activities that result in those IPFs.

The general relationship between cumulative activities and actions, IPFs that result from them, and resources, is depicted in Figure 2-1 using commercial and recreational fishing activity as an example. Here, the reader can see that wind energy development and fishing activity result in a number of IPFs, some of which overlap. Some of these IPFs in turn affect the same resources, showing a cumulative impact on that resource.

Figure 2-2 provides more detail, as is presented in Chapter 3 of this document. Here, the activity of commercial and recreational fishing activity is depicted as resulting in six primary IPFs, including accidental releases (fuel from vessels), air emissions (from vessels), traffic, noise, gear utilization (entanglement), and bycatch. Some of these IPFs overlap with IPFs that may result from offshore wind energy projects (primarily those that are associated with vessel use).

**Figure 2-1. Example: IPFs and Affected Resources Associated with the Cumulative Actions and Activities**

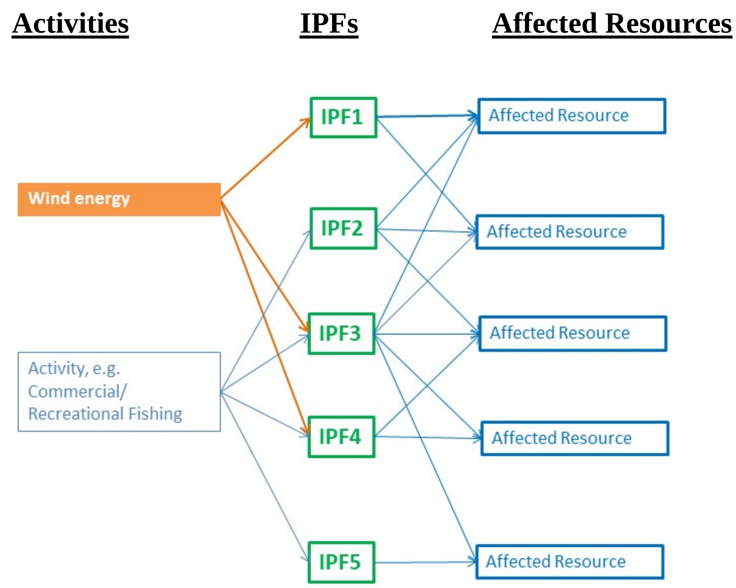



**Figure 2-2. Interactions of Overlapping IPFs**

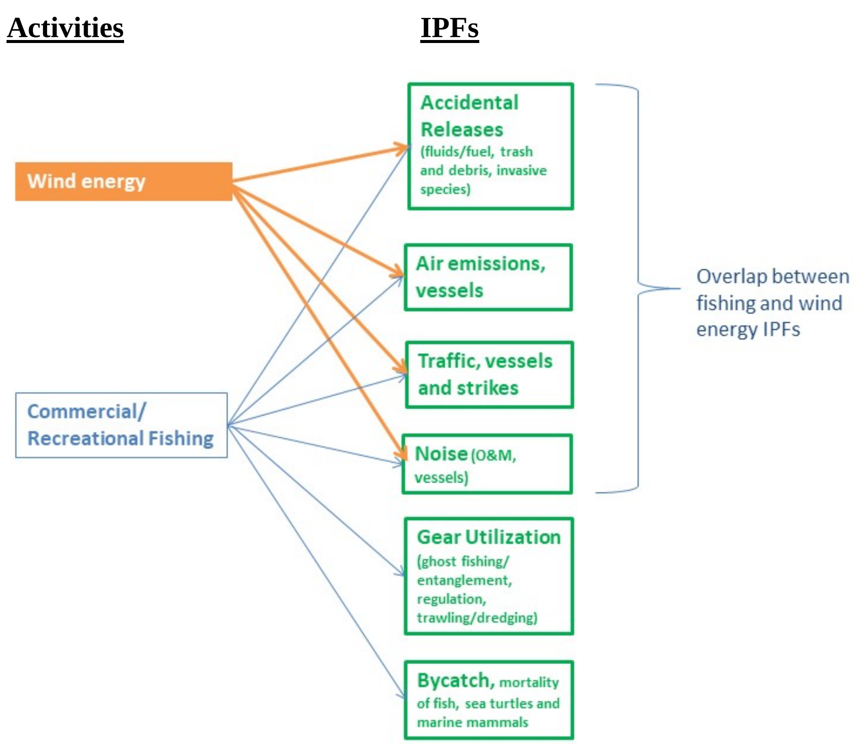
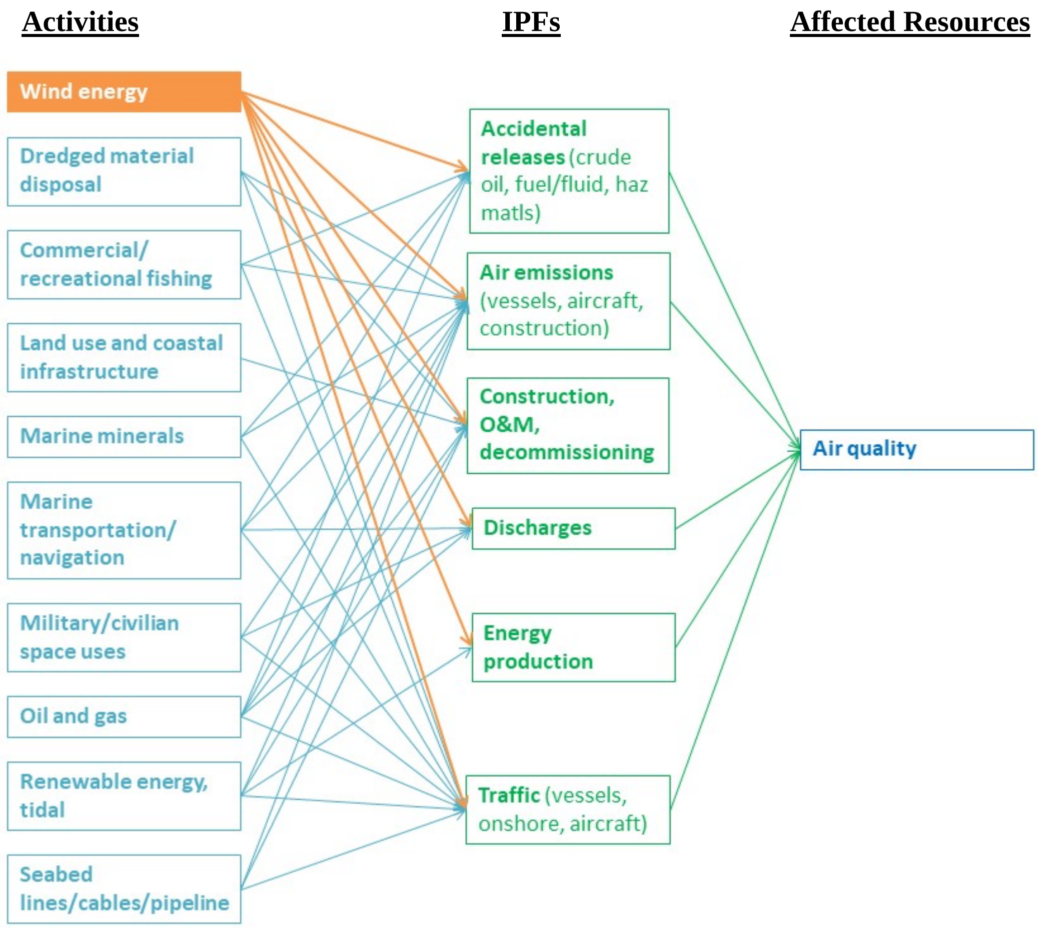


Figure 2-3 describes impacts from the perspective of an affected resource, as is described in Chapter 4 of this document. As shown, the resource Air Quality is affected by multiple IPFs. These IPFs result from a number of actions and activities.

It is this level at which the impacts of offshore wind energy development for one resource are integrated into the overall constellation of IPFs to which a resource is exposed from all of the actions of the cumulative impact scenario.

**Figure 2-3. Multiplicity of Interactions**




The past, present, and reasonably foreseeable future actions that populate the cumulative impacts scenario were identified through an examination of a body of NEPA reviews of offshore activities. IPFs related to those actions were identified and compared to the IPFs of offshore wind energy development. Where an overlap of IPFs occurred, the action and IPFs were included in this cumulative impact scenario.

## 2.3 Description of IPFs

The IPFs associated with offshore activities were identified from BOEM and other federal agency EISs. The resulting list of actions/activities with intersecting IPFs were extracted to create a matrix that contains the action/activity, IPFs, and affected resources for the following relevant activities and other factors:

- other wind energy development activities;
- tidal/wave/hydrokinetic energy projects;

- marine minerals extraction;
- dredged material ocean disposal;
- military ranges and civilian space program uses;
- marine transportation, navigation, and traffic;
- commercial and recreational fishing;
- climate change;
- oil and gas surveys and extraction;
- submarine transmission lines, pipelines, cables, and infrastructure; and
- land use and coastal infrastructure.

Table 2-1 presents the IPFs from other offshore activities that intersect with IPFs from offshore wind development activities. IPFs are described by a primary, categorical name, e.g., “Accidental releases.” Primary IPFs are all related to actions/activities that result in an environmental impact. Sub-IPF descriptions provide additional descriptive detail. Sub-IPF descriptions clarify the various pathways by which an IPF may result in impacts. Sub-IPFs may include qualifiers such as: (a) the IPF source, e.g., vessels, aircraft, structures; (b) the IPF location, e.g., onshore/offshore, above water/underwater; and/or (c) the nature of the IPF, e.g., crude oil, invasive species, explosives.

For example, accidental releases include fuels or hazardous materials leaks, invasive species, suspended sediments, or trash. The impacts of these various materials affect resources in different ways. Similarly, accidental releases from different sources, e.g., vessels and structures have differing pathways by which the IPF will affect resources, i.e., from a mobile source with a release that could occur anywhere and could be widely distributed versus impacts from a known, fixed point such as would occur from a structure.

The complete list of IPFs and their descriptions are presented in Table 2-1. IPFs and sub-IPFs for the actions and activities covered in this document are presented in Table 2-2.

**Table 2-1. IPFs Addressed in This Analysis**

| IPF | Description |
|---|---|
| **Accidental releases**<br>• Crude oil<br>• Fuel/fluids/hazmat<br>• Fuel/fluids/hazmat, structures<br>• Fuel/fluids/hazmat, vessels<br>• Invasive species<br>• Suspended sediments<br>• Trash and debris | Includes unanticipated releases or spills of a fluid or other substance into receiving waters, which can affect water quality and associated resources. Can occur from a stationary source (e.g., oil and gas or renewable energy structures), or a mobile source (e.g., vessels). Accidental releases are distinct from discharges, which are authorized (typically operational) effluents controlled through permit systems (see Discharges, below). |
| **Air emissions**<br>• Aircraft<br>• Onshore<br>• Structures<br>• Structures, generators<br>• Vessels | Includes releases of gaseous or particulate pollutants into the atmosphere from stationary sources, vessels, vehicles, or aircraft, which can affect air quality and associated resources. Can occur both onshore and offshore. |

**Table 2-1. IPFs Addressed in This Analysis**

| IPF | Description |
|---|---|
| **Anchoring**<br>• Bottom-founded structures | Includes both anchoring of a vessel involved in wind energy development or a structure to the sea bottom by use of an anchor or mooring, which can cause alterations to the seafloor from the anchor or anchor chain sweep. Offshore structures (e.g., wind energy, tidal energy, or military use buoys or towers) may also be secured on the seafloor through the use of gravity-based weighted structures (i.e., bottom-founded structures). Does not refer to designated anchorage areas for marine transportation, all of which are far from wind energy lease or planning areas. |
| **Beach restoration**<br>• Improved coastal/dune habitat | Includes renourishment and restoration activities at coastal beaches. Beach renourishment is a process involving replacing sand lost through erosion or drift to improve coastal beach habitat. Can be associated with offshore dredging activities and marine minerals management to supply the sand and gravel used in beach restoration. |
| **Bycatch**<br>• Bird/fish/sea turtle/marine mammals | Includes incidental capture of non-target species such as dolphins, marine turtles, and seabirds during fishing activity, generally in trawling or long-line fishing operations. Most often associated with commercial and recreational fishing. |
| **Demolition/structure removal**<br>• Explosives<br>• Shock wave | Includes removal and demolition of offshore structures. Most commonly associated with oil and gas development and military activities, but possible in decommissioning of wind energy structures. Demolition implies the use of explosives in structure removal. However, water cutting jets also can be used in structure removals and lack explosive/shock wave impacts. |
| **Discharges**<br>• Drilling, sedimentation and burial<br>• Drilling, vessels<br>• Drilling, water column<br>• Onshore point source and non-point sources<br>• Structures<br>• Vessels | Generally, includes routine *permitted* operational effluent discharges to receiving waters. There can be numerous types of vessel and structure discharges, such as bilge water, ballast water, deck drainage, gray water, fire suppression system test water, chain locker water, exhaust gas scrubber effluent, condensate, seawater cooling system effluent, etc. These discharges are generally restricted to uncontaminated or properly treated effluents that may have best management practice or numeric pollutant concentration limitations imposed through Environmental Protection Agency (EPA) National Pollutant Discharge Elimination System (NPDES) permits or U.S. Coast Guard (USCG) regulations. Commercial fishing vessels, however, generally are exempt from coverage under NPDES permits with the exception of ballast water. |

**Table 2-1. IPFs Addressed in This Analysis**

| IPF | Description |
|---|---|
| **Electromagnetic fields** | Power transmission cables and other sources can produce electromagnetic fields (EMFs) that could affect some benthic organisms. The scientific literature provides some evidence of faunal responses to EMF by marine invertebrates, including crustaceans and mollusks (Taormina et al. 2018; Tricas and Gill 2011). BOEM examined the impacts of EMF on commercially and recreationally species important to Southern New England (BOEM 2019f). Based on its review, BOEM concluded OCS wind energy development as currently proposed is not expected to negatively affect important fish species in the southern New England area. Negligible effects, if any, impacts are expected on bottom-dwelling species and no negative effects on pelagic species are expected. |
| **Energy generation, energy security** | Includes generation of electricity and its provision of reliable energy sources as compared with other energy sources (energy security). Associated with renewable energy development operations. |
| **Energy stressors/devices/lasers**<br>• EM devices, high energy lasers | Includes effects of high energy lasers and electromagnetic (EM) devices that may affect biota. Primarily associated with military ranges and civilian space program uses. |
| **Gear utilization**<br>• Bottom trawls, bycatch/benthic disruption<br>• Dredging<br>• Ghost fishing, entanglement<br>• Midwater trawls, bycatch/overfishing<br>• | Includes entanglement and benthic disruptions that may affect biota. Primarily associated with commercial and recreational fishing activities, but also may be associated with marine minerals extraction and military uses. Some gear utilization IPFs (e.g., bottom trawls, dredging) seriously impact benthic communities through disruption or destruction of the seabed. Their impacts are similar in nature but much greater in extent and severity than those caused by other bottom-directed IPFs such as pipeline trenching or submarine cable emplacement that create a relatively narrow trench and backfill in the same operation. |
| **Guidance/fiber optic wires, entanglement** | Includes entanglement of fishing nets ("gear") in guidance or control wires used in military activities offshore (BOEM 2018a). |
| **Ingestion**<br>• Expended materials | Includes ingestion of non-natural materials by biota, especially materials expended and discarded by military operations. |
| **Land disturbance**<br>• Erosion and sedimentation<br>• Onshore construction<br>• Onshore, land use changes | Includes any land disturbances, including erosion and sedimentation, onshore construction, and land use changes associated with residential, commercial, or industrial development. Associated with a wide range of land-based activities, including port, oil and gas, and renewable energy development. |

**Table 2-1. IPFs Addressed in This Analysis**

| IPF | Description |
|---|---|
| **Light**<br>• Structures, above water<br>• Structures, onshore<br>• Vessels or offshore structures, above water<br>• Vessels or offshore structures, underwater<br>• Vessels, above water<br>• Vessels, underwater | Includes light above the water, onshore, as well as underwater. Commonly associated with oil and gas development activities, but also associated with offshore wind development and activities that utilize offshore vessels. |
| **New cable emplacement/ maintenance** | Includes disturbances associated with installing new offshore submarine cables commonly associated with transmission/ telecommunications and offshore wind energy. Benthic impacts are similar to but less than pipeline entrenchment primarily due to the size differences between transmission/telecommunication cables. These are distinct from impacts of bottom trawling. |
| **Noise**<br>• Aircraft<br>• Demolition/structure removal<br>• Drilling<br>• Explosives, weapons<br>• G&G<br>• O&M<br>• Offshore<br>• Onshore<br>• Pier and infrastructure development<br>• Pile driving<br>• Sonar<br>• Trenching<br>• Turbines<br>• Vessels | Includes noise from various sources. Commonly associated with construction activities, geophysical and geotechnical surveys, naval testing and training, and vessel traffic. May be impulsive, e.g., pile driving or weapons detonation, or may be broad spectrum and continuous, e.g., cumulative noise from marine transportation vessels. May also be from natural sources, e.g., wind and wave action. |
| **Pipeline trenching** | Includes water and benthic disturbances associated with installing new pipelines. |
| **Port utilization, expansion** | Includes activities related to port expansion and construction from increased economic activity, or dredging to deepen channels for larger vessels. |
| **Port utilization, maintenance, dredging** | Includes effects associated with port activity and maintenance, specifically channel maintenance dredging. |

**Table 2-1. IPFs Addressed in This Analysis**

| IPF | Description |
|---|---|
| **Presence of structures**<br>• Allisions<br>• Disturbed hydraulics and hydrologic regimes<br>• Entanglement, gear loss/damage<br>• Fish aggregation<br>• Habitat creation<br>• Migration disturbances<br>• Navigation hazard<br>• Offshore, space use conflicts<br>• Onshore<br>• Onshore, space use conflicts<br>• Seabed alterations<br>• Towers<br>• Transmission cable infrastructure<br>• Turbine strikes, birds/bats<br>• Viewshed | Includes effects associated with onshore or offshore structures other than construction-related effects; including entanglement, space-use conflicts, turbine strikes, physical or light-related viewshed impacts, habitat creation and fish aggregation, and scour protection. Associated with any structure fixed to the seafloor but in this context generally refers to renewable energy development. |
| **Regulated fishing effort** | Includes limitations, controls, or effects on commercial and recreational fishing activities. |
| **Resource exploitation**<br>• Overfishing<br>• Prey/predator removal | Includes changes to the sustainability status of fisheries as a result of commercial or recreational fishing activities (including shellfish). |
| **Seabed profile alterations** | Includes physical modifications of the seabed and local sediment environment caused by removal of sedimentary material associated with marine minerals (sand and gravel) extraction; distinct from maintenance dredging of operational ship channels. |
| **Sediment deposition and burial** | Includes deposition of dredged materials at approved offshore dredge spoil disposal sites or to discharges of drilling muds and drill cuttings from oil and gas development or geotechnical survey activity. Also can be associated with construction-related activities that have benthic interactions, e.g., setting anchors or submarine cable emplacement. |
| **Traffic**<br>• Aircraft<br>• Onshore<br>• Vessel strikes, sea turtles and marine mammals<br>• Vessels<br>• Vessels, collisions | Includes marine and onshore vessel and vehicle congestion, including vessel strikes of sea turtles and marine mammals, collisions, and allisions. |

**Table 2-1. IPFs Addressed in This Analysis**

| IPF | Description |
| --- | --- |
| **Climate Change IPFs:**<br>Ocean acidification<br>Warming and sea level rise<br>• Storm severity/frequency<br>• Altered habitat/ecology<br>• Altered migration patterns<br>• Disease frequency<br>• Property/infrastructure damage<br>• Protective measures (barriers, seawalls)<br>• Storm severity/frequency, sediment erosion, deposition | Includes the effects associated with climate change, storm severity/frequency, and sea level rise. Ocean acidification refers to the effects associated with the decreasing pH of seawater from rising levels of atmospheric $CO_2$.<br><br>Note, although climate change is not an action, its reach touches nearly all actions included above. Climate change is altering the baseline against which the impacts of human actions are measured. Climate change is included in this list as an action and has IPFs that interact with those of Outer Continental Shelf (OCS) wind development to potentially affect resources discussed in this document. Climate change is described as an action in Chapter 3 and its interactions and impacts are discussed in Chapter 4. |

**Table 2-2. Primary IPFs and Associated Sub-IPFs Addressed in This Analysis, by Activity**

| |
|---|
| **Climate change** |
| Warming and sea level rise, altered habitat/ecology |
| Warming and sea level rise, altered migration patterns |
| Warming and sea level rise, disease frequency |
| Warming and sea level rise, property/infrastructure damage |
| Warming and sea level rise, protective measures (barriers, seawalls) |
| Warming and sea level rise, storm severity/frequency |
| Warming and sea level rise, storm severity/frequency, sediment erosion, deposition |
| Ocean acidification |
| **Dredged material ocean disposal** |
| Accidental releases, fuel/fluids/hazmat |
| Accidental releases, trash and debris |
| Air emissions, vessels |
| Beach restoration, improved coastal/dune habitat |
| Discharges, vessels |
| Noise, vessels |
| Port utilization, maintenance, dredging |
| Sediment deposition and burial |
| Traffic, vessel strikes, sea turtles and marine mammals |
| Traffic, vessels |
| **Marine transportation, navigation and traffic** |
| Accidental releases, fuel/fluids/hazmat |
| Accidental releases, invasive species |
| Accidental releases, trash and debris |
| Air emissions, vessels |
| Discharges, vessels |
| Noise, vessels |
| Port utilization, expansion |
| Port utilization, maintenance, dredging |
| Traffic, vessel strikes, sea turtles and marine mammals |
| Traffic, vessels |
| Light, vessels, above water |
| Light, vessels, underwater |
| **Commercial and recreational fishing** |
| Accidental releases, fuel/fluids/hazmat |
| Accidental releases, invasive species |
| Accidental releases, trash and debris |
| Air emissions, vessels |
| Bycatch, bird/fish/sea turtle/marine mammals |
| Discharges, vessels |
| Gear utilization, bottom trawls, bycatch/benthic disruption |
| Gear utilization, ghost fishing, entanglement |
| Gear utilization, midwater trawls, bycatch/overfishing |
| Noise, O&M |
| Noise, vessels |
| Regulated fishing effort |
| Resource exploitation, overfishing |
| Resource exploitation, prey/predator removal |
| Traffic, vessel strikes, sea turtles and marine mammals |
| Traffic, vessels |
| Light, vessels, above water |
| Light, vessels, underwater |

**Table 2-2. Primary IPFs and Associated Sub-IPFs Addressed in This Analysis, by Activity**

| |
|---|
| **Land use and coastal infrastructure** |
| Accidental releases, fuel/fluids/hazmat |
| Air emissions, onshore |
| Discharges, onshore point source and non-point sources |
| Land disturbance |
| Land disturbance, erosion and sedimentation |
| Land disturbance, onshore, land use changes |
| Noise, pier and infrastructure development |
| Presence of structures, viewshed |
| Traffic, onshore |
| Traffic, vessels |
| Light, structures, onshore |
| **Marine minerals extraction** |
| Accidental releases, fuel/fluids/hazmat, vessels |
| Accidental releases, trash and debris |
| Discharges, vessels |
| Gear utilization, dredging |
| Noise, O&M |
| Seabed profile alterations |
| Traffic, vessel strikes, sea turtles and marine mammals |
| Traffic, vessels |
| **Military ranges and civilian space program uses** |
| Accidental releases, fuel/fluids/hazmat |
| Accidental releases, trash and debris |
| Air emissions, aircraft |
| Air emissions, vessels |
| Anchoring, bottom-founded structures |
| Demolition/structure removal |
| Discharges, vessels |
| Energy stressors/devices/lasers, EM devices, high energy lasers |
| Gear utilization, dredging |
| Guidance/fiber optic wires, entanglement |
| Ingestion, expended materials |
| Light, structures, onshore |
| Noise |
| Noise, aircraft |
| Noise, explosives, weapons |
| Noise, pile driving |
| Noise, sonar |
| Noise, vessels |
| Presence of structures |
| Presence of structures, onshore |
| Traffic, aircraft |
| Traffic, vessel strikes, sea turtles and marine mammals |
| Traffic, vessels |
| **Submarine transmission lines, pipelines, cables and infrastructure** |
| Accidental releases, fuel/fluids/hazmat |
| Accidental releases, trash and debris |
| Air emissions, vessels |
| Discharges, vessels |
| Electromagnetic fields |
| New cable emplacement/maintenance |

**Table 2-2. Primary IPFs and Associated Sub-IPFs Addressed in This Analysis, by Activity**

| |
|---|
| Noise |
| Noise, vessels |
| Presence of structures, entanglement, gear loss/damage |
| Presence of structures, onshore |
| Presence of structures, transmission cable infrastructure |
| Traffic, vessel strikes, sea turtles and marine mammals |
| Traffic, vessels |
| **Oil and gas surveys and extraction** |
| Accidental releases, crude oil |
| Accidental releases, fuel/fluids/hazmat |
| Accidental releases, fuel/fluids/hazmat, structures |
| Accidental releases, trash and debris |
| Air emissions, aircraft |
| Air emissions, onshore |
| Air emissions, structures |
| Air emissions, vessels |
| Anchoring |
| Demolition/structure removal |
| Demolition/structure removal, explosives |
| Demolition/structure removal, shock wave |
| Discharges, drilling, sedimentation and burial |
| Discharges, drilling, vessels |
| Discharges, drilling, water column |
| Discharges, onshore point source and non-point sources |
| Discharges, structures |
| Discharges, vessels |
| Land disturbance, onshore construction |
| Light, vessels or offshore structures, above water |
| Light, structures, onshore |
| Light, vessels or offshore structures, underwater |
| Noise, aircraft |
| Noise, demolition/structure removal |
| Noise, drilling |
| Noise, G&G |
| Noise, O&M |
| Noise, offshore |
| Noise, onshore |
| Noise, trenching |
| Noise, vessels |
| Pipeline trenching |
| Port utilization, expansion |
| Presence of structures, offshore, space use conflicts |
| Presence of structures, onshore, space use conflicts |
| Traffic, aircraft |
| Traffic, vessel strikes, sea turtles and marine mammals |
| Traffic, vessels |
| **Renewable energy development, wind** |
| Accidental releases, fuel/fluids/hazmat |
| Accidental releases, fuel/fluids/hazmat, structures |
| Accidental releases, suspended sediments |
| Accidental releases, trash and debris |
| Air emissions |

**Table 2-2. Primary IPFs and Associated Sub-IPFs Addressed in This Analysis, by Activity**

| |
|---|
| Air emissions, aircraft |
| Air emissions, onshore |
| Air emissions, structures, generators |
| Air emissions, vessels |
| Anchoring, bottom-founded structures |
| Discharges, onshore point source and non-point sources |
| Discharges, structures |
| Discharges, vessels |
| Electromagnetic fields |
| Energy generation, energy security |
| Light, vessels, above water |
| Light, structures, above water |
| Light, structures, onshore |
| New cable emplacement/maintenance |
| Noise |
| Noise, aircraft |
| Noise, G&G |
| Noise, O&M |
| Noise, pile driving |
| Noise, turbines |
| Noise, vessels |
| Port utilization, expansion |
| Presence of structures |
| Presence of structures, allisions |
| Presence of structures, entanglement, gear loss/damage |
| Presence of structures, fish aggregation |
| Presence of structures, habitat creation |
| Presence of structures, migration disturbances |
| Presence of structures, navigation hazard |
| Presence of structures, offshore, space use conflicts |
| Presence of structures, onshore |
| Presence of structures, seabed alterations |
| Presence of structures, towers |
| Presence of structures, transmission cable infrastructure |
| Presence of structures, turbine strikes, birds/bats |
| Presence of structures, viewshed |
| Traffic, aircraft |
| Traffic, vessel strikes, sea turtles and marine mammals |
| Traffic, vessels |
| Traffic, vessels, collisions |

## 2.4 GUIDELINES FOR SPATIAL BOUNDARIES FOR THE CUMULATIVE IMPACTS SCENARIO

Based on 40 CFR 1508.7, cumulative impacts are the incremental effects of a proposed action on resources when added to other past, present, or reasonably foreseeable future actions that affect those same resources, regardless of which agency or person undertakes the actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a given period. EPA guidance states that “Geographic boundaries and time periods used in cumulative impact analysis should be based on all resources of concern and all of the actions that may contribute, along with the project effects, to cumulative impacts. Generally, the scope of analysis will be broader than the scope of analysis used in assessing direct or indirect effects" (EPA 1999).

This section discusses the spatial boundaries that should be considered to determine resource-specific cumulative impacts due to direct and indirect impacts associated with a proposed offshore wind energy action. The analysis area for cumulative impacts varies for each resource as shown in Table 2-3. For example, BOEM uses a localized geographic scope to evaluate cumulative impacts for resources that are fixed in nature (i.e., their location is stationary such as benthic and archaeological resources), or for resources where impacts from a proposed action would only occur in waters in and around the proposed project area (e.g., water quality). However, given the migratory nature of marine mammals, sea turtles, fisheries resources, and birds, for example, the cumulative impact analysis area for these resources includes a much broader area. The variation seen in the extent of the analysis area is also due to the substantial differences in the nature, quality, and amount of available, relevant information upon which these determinations of analysis areas for each resource were based. This table provides available guidance, examples, and data to inform a decision about the geographic scope for consideration in a cumulative impacts analysis.

**Table 2-3. Cumulative Impacts Scenario Action- and Resource-Specific Geographic Analysis Areas**

<table>
<tr><th>Resource</th><th>Cumulative Impact Scenario Geographic Analysis Boundaries</th></tr>
<tr><td>Acoustic Environment</td><td>
Based on review of Tougaard (2009) for seals and porpoises and Stamieszkin (nd) for whales, cumulative impact scenarios for turbine installation and operation should consider sound sources within a 2 km radius of the project.
Underwater noise was recorded from three different types of wind turbines in Denmark and Sweden during normal operation. Wind turbine noise was only measurable above ambient noise at frequencies below 500 Hz. The 1/3-octave noise levels were compared with audiograms of harbor seals and harbor porpoises. Maximum 1/3-octave levels were in the range 106–126 dB re 1 μPa rms. Audibility was low for harbor porpoises extending 20–70 m from the foundation, whereas audibility for harbor seals ranged from less than 100 m to several kilometers. Behavioral reactions of porpoises appear unlikely except if they are very close to the foundations. Behavioral reactions from seals cannot be excluded up to distances of a few hundred meters. It is unlikely that the noise reaches dangerous levels at any distance and is considered incapable of masking acoustic communication by seals and porpoises (Tougaard 2009).
Data from Stamieszkin (nd):
<table>
<tr><th>Source</th><th>Sound pressure (dB re uPa)</th><th>Distance (m)</th></tr>
<tr><td>Pile driving</td><td>approx. 200</td><td>1</td></tr>
<tr><td>Drilling</td><td>approx. 120</td><td>115-259</td></tr>
<tr><td>Dredging</td><td>approx. 140</td><td>200</td></tr>
</table>
One review concluded that North Atlantic right whales may respond to wind turbine operational noise at distances up to a few kilometers away, in a quiet habitat (Madsen et al. 2006 as cited in Stamieszkin).
Construction and decommissioning noise comes from machines and vessels, pile-driving, explosions and installation of wind turbines. Measurements carried out by the German Federal Ministry of Environment on two platforms reached peak levels of 193 dB at 400 m from the pile (North Sea) and 196 dB at 300 m (Baltic Sea). Nedwell et al. (2004) as cited in Gill (2005) reports peaks up to 260 dB in foundation construction and 178 dB in cable laying at 100 m from the sound source. These high sound levels may cause permanent or temporary damage to the acoustics systems of animals in the vicinity of the construction site (Gill 2005; Koeller et al. 2006). However, there is not enough scientific knowledge to determine the maximum thresholds permitted for certain effects (Koeller et al. 2006; Thomsen et al. 2006). Close collaboration between
</td></tr>
</table>

**Table 2-3. Cumulative Impacts Scenario Action- and Resource-Specific Geographic Analysis Areas**

| Resource | Cumulative Impact Scenario Geographic Analysis Boundaries |
|---|---|
| **Acoustic Environment (cont'd)** | physicists, engineers and biologists is necessary to get relevant information and obtain standardization of the measurement procedures in offshore developments (Koeller et al. 2006).<br><br>The measurements from FINO-1 at 400 m from the source revealed maximum peaks of 180 dB (Thomsen et al. 2006). The measurements carried out during construction of North Hoyle wind farm in UK indicate that:<br>• The peak noise of pile hammering at 5m depth was 260 dB and at 10 m depth was 262 dB;<br>• There were no preferential directions for propagation of noise;<br>• The behavior of marine mammals and fish could be influenced several kms away from the turbine (Nedwell et al, 2004; Thomsen et al, 2006).<br><br>**Calculated Ranges for Avoidance Distance for Different Marine Species**<br><br>**Species** / **Distance**<br>Salmon: 1,400 m<br>Cod: 5,500 m<br>Dab: 100 m<br>Bottlenose dolphin: 4,600 m<br>Harbor porpoise: 1,400 m<br>Harbor seal: 2,000 m<br><br>NMFS previously established thresholds for assessing auditory impacts as RMS SPL 180 dB for cetaceans and 190 dB for pinnipeds. Recent updates include a tool (link to spreadsheet is below) for calculating the onset of permanent threshold shifts for all sound sources (NOAA Technical Memo NMFS-OPR-59 2018). https://www.fisheries.noaa.gov/national/marine-mammal-protection/marine-mammal-acoustic-technical-guidance<br><br>Pile driving noise impacts are documented for several fish species; however, recovery is documented to occur within 10 days with no survival effects. Harbor porpoises show responsiveness up to 20 km from pile driving. Mitigation for pile driving includes soft starts or ramp up of sound to allow marine mammals and fish to avoid full impact by leaving the area (Baily et al. 2014).<br><br>The National Oceanic and Atmospheric Administration (NOAA) Cetacean & Sound Mapping tool uses environmental descriptors and the distribution, density, and acoustic characteristics of human activities within U.S. waters to develop first-order estimates of their contribution to ambient noise levels at multiple frequencies, depths and spatial/temporal scales. |
| **Air Quality** | The Clean Air Act covers emissions of air pollutants that occur up to 25 nautical miles from shore. The air shed of each area potentially impacted by the proposed project, including the lease area, the on-land construction areas, and the mustering port(s) provides sufficient buffer and captures any possible impacts. Ozone, as a regional pollutant, is an exception, and while the impacts on ozone formation are expected to be negligible, a full review of cumulative impacts on regional ozone development is needed. |

**Table 2-3. Cumulative Impacts Scenario Action- and Resource-Specific Geographic Analysis Areas**

| Resource | Cumulative Impact Scenario Geographic Analysis Boundaries |
|---|---|
| **Areas of Special Concern** | EFH and sensitive areas of concern are identified by NOAA's Fisheries Habitat Conservation Division under Magnuson-Stevens Act consultation during the permitting process. Areas can include fishery nursery and foraging habitats and hard bottom areas affected by transmission lines. |
| **Birds and Bats** | Birds that occur on the Atlantic OCS may migrate the entire eastern seaboard. Therefore, all activities occurring in their migratory range have the potential to contribute impacts, with collisions and displacement being the most serious issues. Bird impacts are site-specific, species-specific, and seasonal. Some evidence of avoidance behavior has been documented (Baily et al. 2014).<br><br>For bats, the cumulative impacts scenario includes the U.S. East Coast to capture migratory species. Hatch et al. (2013) found bats located between 16.9 and 41.8 km off the coasts of New Jersey, Delaware, and Virginia. Flight height was >200m for 9 of the 11 bats observed in the study.<br><br>On-land construction areas and port activities that may impact bats should be considered. Bats have been recorded in the Atlantic as far offshore as 22 km (12 nm) from March to June and from August to October, with sightings as far offshore as 16 km (9 nm) (BOEM 2013a), although Allison et al. (2019) report bats foraging or migrating as far as 40 km offshore. |
| **Benthic Communities and Habitat** | A ten-mile radius around the project area accounts for some transport of water masses and for benthic invertebrate larval transport due to ocean currents. While sediment transport beyond 10 miles is possible, sediment transport related to proposed-project activities is likely to be on a smaller spatial scale than 10 miles. Maximum extent of the 10 mg/L sediment contour was estimated just under 10 miles for dredging (BOEM 2018a) |
| **Coastal Habitats** | The coastal habitat impacted by any project is defined by the Coastal Zone Management Plan of the closest state, neighboring state(s), and any state where onshore activity (including transmission lines or port facilities) are located. |
| **Commercial and Recreational Fishing** | Key factors to be considered include the extent to which (1) the presence of structures may affect the ability of commercial fishing vessels to operate in the vicinity of the wind project, and (2) vessel traffic related to the wind project would affect regional fishing vessel traffic. Kirkpatrick et al. (2017) selected a one nautical mile spatial boundary around a wind farm to identify potential recreational fishing vessels that may potentially be impacted.<br><br>One energy industry representative indicated at a public meeting the need for a buffer area of <10 miles during construction, which was expected for approximately one week per turbine, but there would be no fishing restrictions per se (BOEM 2016d). In contrast, USCG required a 500-foot exclusion zone during construction for each turbine while activities were occurring. |
| **Cultural, Historical, and Archaeological Resources** | Programmatic Agreements with the coastal State Historic Preservation Offices (SHPOs) stipulate the area for consideration as:<br>1. The depth and breadth of the seabed potentially impacted by proposed seafloor/ bottom-disturbing activities associated with the activities;<br>2. The onshore viewshed from which lighted structures would be visible; and<br>3. The depth and breadth and viewshed of onshore locations where transmission cables or pipelines come ashore until they connect to existing power grid structures.<br><br>In addition to Programmatic Agreements, a BOEM guidance document defines a cultural landscape as a geographic area associated with a historic event, activity, or person, or an area exhibiting other cultural or aesthetic values. This definition is |

**Table 2-3. Cumulative Impacts Scenario Action- and Resource-Specific Geographic Analysis Areas**

| Resource | Cumulative Impact Scenario Geographic Analysis Boundaries |
|---|---|
| | inclusive of historic sites, historic designed landscapes, historic vernacular landscapes, and ethnographic landscapes (BOEM 2015c). |
| **Energy Production and Distribution** | Because of the wide range of types and locations of energy production and distribution elements, the analysis of cumulative impacts on this resource should consider the entire area off the Atlantic coast. The factors that are most likely to have cumulative impacts on energy production and distribution are vessel traffic (traffic IPF) and the presence of structures (presence of structures IPF) in proposed projects. The social and environmental beneficial impacts of OCS wind energy production also are considerations. |
| **Finfish, EFH, Threatened and Endangered Fish, and Invertebrates** | The Scotian Shelf, Northeast Shelf, and Southeast Shelf large marine ecosystems (LMEs) that include or are immediately adjacent to proposed activities are likely to capture the majority of the range for most species in this group.[a] |
| **Land Use and Coastal Infrastructure** | Offshore wind energy development activities have the potential to affect onshore land use and coastal infrastructure, particularly due to onshore construction activities, port modifications, and cable landings that may occur as part of these actions, as well as in the event of accidental releases. Onshore development, land use, and infrastructure/ port development are highly localized and zoning and planning rules should be examined on a site-specific basis. Offshore wind projects are likely to involve new or upgraded cable landing facilities to connect generating units (i.e., turbines) to onshore electricity transmission infrastructure. Atlantic states have a variety of definitions for their respective coastal zones and development based on their CZM plans (https://coast.noaa.gov/czm/media/StateCZBoundaries.pdf). |
| **Marine Mammals** | Marine mammals generally migrate throughout the entire eastern seaboard. The Scotian Shelf, Northeast Shelf, and Southeast Shelf LMEs are likely to capture the majority of the movement range for most species in this group. Therefore, all activities occurring in their migratory range have the potential to contribute impacts. Note: seasonal restrictions imposed on activities may reduce or negate impacts. |
| **Marine Minerals** | The area of impact from marine minerals collection does not extend much beyond the actual dredging footprint. Recovery of the benthic community is expected after a few years (BOEM 2013c). |
| **Marine Transportation, Navigation, and Traffic** | The area surrounding any ports supporting construction and O&M must be included. In addition, existing marine traffic and any proposed alterations to that traffic are contributing factors. U.S. territorial waters extend 12 nm off the coast and vessels are required by the USCG to have an operating automatic identification system tracking their movement within this boundary. Certain exceptions apply, such as for military vessels and smaller vessel sizes and types.<br>In addition, the USCG recently revised their guidance towards the role and responsibility of the USCG in the planning and development of wind energy development. Based on this guidance, the USCG can recommend to BOEM that a wind energy developer conduct a Navigations Safety Risk Assessment (NSRA) so that navigation effects are evaluated on a case by case basis. The NSRA guidance recommends the *minimum* planning distances between offshore structures and vessel traffic routes as 2 nautical miles from the seaward boundary of a traffic route and 5 nautical miles from the entry or exit of a traffic route (USCG 2019). The USCG also suggests cumulative analysis be conducted and identify mitigation measures when multiple wind energy developments are in close proximity to each (USCG 2019). |

**Table 2-3. Cumulative Impacts Scenario Action- and Resource-Specific Geographic Analysis Areas**

| Resource | Cumulative Impact Scenario Geographic Analysis Boundaries |
|---|---|
| **Military Ranges & Civilian Space Program Use** | The DoD Siting Clearinghouse requires formal review for any energy generation or transmission projects >199 ft above ground level and provides informal review prior to filing with the Dept of Transportation for all other projects. However, DoD does not have a go/no go threshold on height or distance of projects that might impact military operations (www.acq.osd.mil/dodsc).<br><br>For comparison, France uses a 30 km (16.2 nm) buffer for radar and low-level flight training. The United Kingdom recommends against siting turbines within 2 nm of a helicopter main route (due to wake turbulence) or within 9 nm of an oil platform. |
| **Pelagic Communities** | Directed field studies of the impact on pelagic communities is limited. Where fishing or bottom trawling are limited around wind structures, greater biodiversity occurs than in unprotected areas. However, alien species also may be transported and take hold as well (Slavik et al. 2017).<br><br>Brostrom (2008) reports modeling and idealized numerical efforts predict a wind speed of 5-10 m/s may generate upwelling/downwelling velocities exceeding 1 m/day and suggested this upwelling would most likely strongly influence the local ecosystem.<br><br>Where fishing or bottom trawling are limited around wind structures, greater biodiversity occurs than in unprotected areas, although alien species also occur (Slavik et al. 2017). However, hydroacoustic records did not show any wind farm effects on the distribution of pelagic fish (Floeter 2017). The applicability of these North Sea study to potential impacts in Atlantic waters off the U.S. east coast is not known. |
| **Physical Oceanography** | MMS (2007) assessed the impacts of OCS wind energy development on the physical oceanography in the Atlantic region, including technology testing, site characterization, construction/installation, operations, and decommissioning phases and concluded impacts would produce:<br>• a very slight reduction in current energy from support structure drag<br>• a decrease in wave height near support structures caused by wave interception and downwind of the facility caused by a decreased wind energy<br>• an increase wave height and current energy from structure removal during decommissioning to return the system to its pre-development condition.<br>In all phases, impacts would be negligible or small in magnitude; limited locally to the immediate vicinity of the facility; very difficult or not measurable outside the vicinity of the support; and except for the operational phase, temporary. BOEM concluded no mitigation measures would be required because wind energy development would have no measurable impacts on currents or waves beyond the immediate vicinity of associated structures.<br><br>By way of example, BOEM's review (2013b) of leasing and site assessment impacts offshore Massachusetts provided descriptive current and wave data to provide context for the surrounding physical environment and concluded impacts would, at worst, be minor, localized, and temporary. BOEM (2016c) eliminated discussions on physical oceanography in the review of potential impacts of leasing and site assessment actions offshore New York. Discussions of physical oceanography were not included in leasing and site assessment actions for the Mid-Atlantic (2014b) nor for Vineyard Wind (BOEM 2018a) that covered all phases of OCS wind energy development.<br><br>A field study in the North Sea conducted about 100 miles northwest of Bremerhaven found vertical mixing is increased within the OWFs, leading to a doming of the thermocline and a subsequent transport of nutrients into the surface mixed layer. This empirical finding is consistent with modeling exercises that projected increased |

**Table 2-3. Cumulative Impacts Scenario Action- and Resource-Specific Geographic Analysis Areas**

| Resource | Cumulative Impact Scenario Geographic Analysis Boundaries |
|---|---|
| | vertical mixing from wind farm foundation structures (Floeter 2017). This finding is also consistent with modeling and idealized numerical experiments that predict a wind speed of 5–10 m/s may generate upwelling/downwelling velocities exceeding 1 m/day. The author concluded upwelling is most likely to strongly influence the local ecosystem (Brostrom, 2008). |
| **Sea Turtles** | Sea turtles that occur on the Atlantic OCS may migrate the entire eastern seaboard, with Atlantic nesting sites located mainly on southern beaches from North Carolina through Florida (90% of all US nesting is in Florida). Therefore, all activities occurring in their migratory range have the potential to contribute impacts.<br><br>Differing species' nesting times occur throughout the year with the majority nesting during May – October. Hatchlings emerge 50-60 days later.<br><br>Sea turtles are believed to utilize the earth's magnetic fields during migration. this suggests electromagnetic fields from energy development may impact sea turtles (Tethys 2020). |
| **Seabed Cables/Pipelines/ Telecommunications Lines** | At a distance of 100 m from transmission lines, DC magnetic fields are reduced to background (along and above the seabed). However, migrant species are likely to encounter multiple cables during migration (Tricas and Gill 2011).<br><br>During the dredging works for the creation of the sand base and upper core, the turbidity will locally and temporarily change. Model results show that the background value in the region of 4 mg/l will not be exceeded for more than 20% of the dredging time for a scenario with one trailing suction hopper dredger (TSHD) of 10,000 $m^3$. For a scenario with 2 TSHD of 5,000 $m^3$, involving more frequent dredging and dumping, the background value of 4 mg/l will not be exceeded for more than 30% of the time. The dredging activity causes the highest turbidity. The dredging plume is higher in concentration but smaller in size for the scenario with 2 TSHD. The dredging plume contour is more than 1,300 m long and moves over a distance of up to 2.5 km. Compared to turbidity concentrations during natural storms, this is a small negative effect, with temporary habitat disturbance of the benthic fauna, fish and marine mammals (Sarah et al. 2014). |
| **Demographics, Employment, Economic Resources, and Environmental Justice** | The relevant geographic areas for socioeconomics will vary by project and will be influenced by: the specific fishing industries that are active, the onshore development area, and the type of development anticipated from the action. Disadvantaged communities that may rely on affected industries should be considered. |
| **Terrestrial and Coastal Fauna** | Onshore construction will have a direct impact on local fauna and the size and location will determine the area of consideration. As one example, a ½-mile buffer around all land areas that would be disturbed was used in the Vineyard Wind draft EIS (BOEM 2018a), although it also noted that the resources in that area generally tended to have limited geographic ranges and the ½-mile buffer may not be applicable to other areas of the U.S. east coast. |
| **Tourism and Recreation** | Should include the entire footprint of the proposed project (including land use and coastal infrastructure areas), plus the visual resources and recreational fisheries analysis areas. |
| **Visual Resources** | Visual resources include the aesthetic, perceptual, and experiential aspects of any objects and features that make landscapes and seascapes distinctive as well as key observation points. Impacts to visual resources are highly site-specific and can depend on the number of viewers as well as the perception of impacts by different viewers. |

**Table 2-3. Cumulative Impacts Scenario Action- and Resource-Specific Geographic Analysis Areas**

| Resource | Cumulative Impact Scenario Geographic Analysis Boundaries |
|---|---|
| **Water Quality** | Ten-mile radius around the development area, the cable corridor, and vessel approach routes to port facilities that may be used by the proposed project. This area would account for some transport of water masses (BOEM 2018a).<br>The CZMP and state water quality standards of each coastal state also may define mixing zones. |

[a] LMEs are delineated based on ecological criteria including bathymetry, hydrography, productivity, and trophic relationships among populations of marine species, and are used by NOAA as the basis for ecosystem-based management. The Scotian Shelf LME is bordered to the north by the Laurentian Channel and to the south by the southern edge of the Scotian Shelf at the Fundian Channel (Northeast Channel); it contains the St. Lawrence Estuary. The Northeast Shelf LME extends from the southern edge of the Scotian Shelf (in the Gulf of Maine) to Cape Hatteras, North Carolina. The Southeast Shelf LME extends from the Straits of Florida to Cape Hatteras, North Carolina. These LMEs extend from the coastline offshore to the shelf break (at ~100 to 200 m depth).

# 3. CUMULATIVE IMPACTS SCENARIO

## 3.1 RENEWABLE ENERGY – OFFSHORE WIND

### *3.1.1 Description of Action and Activities*

Offshore wind energy development projects involve several phases: site characterization surveys, site assessment activities, construction/installation, operation and maintenance (O&M), and decommissioning. This section describes the wind energy development activities being conducted in BOEM lease areas that should be considered in the cumulative impacts scenario.

Under the renewable energy regulations, the issuance of leases and subsequent approval of wind energy development on the OCS is a staged decision-making process and occurs over several years with varying impacts. The process follows the following general steps:

- **Lease Issuance** – BOEM issues a commercial wind energy lease which gives the lessee exclusive right to seek BOEM approval for the development of the lease area. Surveys to gather information in support of seeking approval are reasonably foreseeable at this stage.
- **Site Assessment Plan (SAP) Approval** – BOEM assumes every lessee will plan to install one or more meteorological buoys and/or towers for site assessment purposes. The lessee has one year after lease execution to submit a SAP if installing site assessment facilities is proposed. The SAP contains a detailed proposal for the construction and/or installation of meteorological towers or buoys. BOEM must approve the SAP before site assessment activities begin. After SAP approval, the lessee must complete the site characterization and site assessment activities needed to support a Construction and Operation Plan (COP) during the five-year assessment term.
- **Construction and Operation Plan (COP) Approval** – Six months prior to the end of the five-year assessment term, the lessee submits a COP that contains a detailed plan for the construction and operation of a wind energy project on the lease area. COP approval triggers a project-specific NEPA document. After completion of the NEPA document, BOEM may approve, approve with modification, or disapprove a lessee's COP. If approved, the lessee is allowed to construct and operate wind turbine generators and associated facilities for the operations term of the lease (typically 25 years) (BOEM 2016a).

#### *3.1.1.1 Site Characterization Studies*

Site characterization activities consist of geological and geophysical (G&G) surveys, including high-resolution geophysical (HRG), geotechnical/sub bottom sampling, and biological surveys to determine shallow hazards, archaeological, geological, geotechnical, and biological resources. A lessee is required to provide the results of these surveys with its SAP or COP.

BOEM assumes site characterization surveys on all existing leases over the entire lifecycle of a proposed project will occur. Surveys will be performed pre-construction, post-construction, and likely post-decommissioning. The following describes the assumptions for survey and sampling activities:

- Site characterization generally would likely take place in the first three years following execution of the lease (based on the fact that a lessee would likely complete the majority of site characterization prior to installing a meteorological tower and/or buoy, which would leave approximately two years for site assessment). However, the situation can be more complex. A lease may also host multiple projects with individual COPs or may have a phased COP that covers more than one development.
- Lessees would likely survey most or all of the proposed lease area during the 5-year site assessment term to collect required geophysical information for siting of a meteorological tower

and/or buoys and commercial facilities (wind turbines). The surveys may be completed in phases, with the meteorological tower and buoy areas likely to be surveyed first.

- The lessee would likely survey most or all OCS blocks in the traffic separation scheme (TSS) buffer zone since cable may be buried in the buffer zone area (although no site assessment structure placement would be allowed in the TSS buffer zone).
- Lessees would not use air guns, which are typically used for deep penetration two-dimensional or three-dimensional exploratory seismic surveys to determine the location, extent, and properties of oil and gas resources (BOEM 2016c).

Table 3-1 describes the typical site characterization surveys, the types of equipment and/or method used, and which resources the survey information would be used to inform (BOEM 2016c).

**Table 3-1. Site Characterization Survey Assumptions**

| Survey Type | Survey Equipment and/or Method | Resource Surveyed or Information Used to Inform |
|---|---|---|
| High-resolution geophysical surveys | Side-scan sonar, sub-bottom profiler, magnetometer, multi-beam echosounder, airguns | Shallow hazards,[a] archaeological,[b] bathymetric charting, benthic habitat |
| Geotechnical/sub-bottom sampling [c] | Vibracores, deep borings, cone penetration tests | Geological [d] |
| Biological [e] | Grab sampling, benthic sled, underwater imagery/sediment profile imaging | Benthic habitat |
| | Aerial digital imaging; visual observation from boat or airplane | Avian |
| | Ultrasonic detectors installed on survey vessels used for other surveys | Bats |
| | Visual observation from boat or airplane | Marine fauna (marine mammals and sea turtles) |
| | Direct sampling of fish and invertebrates, including midwater, pelagic trawl nets, plankton and neuston nets, drift or gill nets, bottom trawls, dredges, bottom grabs, and sediment corers | Fish/Invertebrates |

[a] 30 CFR § 585.610(b) and 30 CFR § 585.626(a)(1) [d] 30 CFR § 585.610(b)(4) and 30 CFR § 585.616(a)(2)
[b] 30 CFR § 585.626(a) and 30 CFR § 585.610–585.611 [e] 30 CFR § 585.610(b)(5) and 30 CFR § 585.626(a)(3)
[c] 30 CFR § 585.610(b)(1) and 30 CFR § 585.626(a)(4)

#### *3.1.1.2 Site Assessment Activities*

Site assessment involves data collection and evaluation of meteorological conditions, such as wind resources, from meteorological structures (buoys or towers). Buoys can be used as an alternative or in addition to towers for wind, wave, and current data collection. Meteorological buoys are typically anchored at fixed locations and may be moved within the lease area. The buoy types most likely used for offshore wind data collection are discus-shaped, boat-shaped, and spar buoys (BOEM 2013b). Meteorological towers most often consist of a mast and data collection devices mounted on a platform supported by one or multiple pilings. The mast may be either a monopole or lattice (similar to a radio tower). A deck would be supported by a single monopole, tripod, or a steel jacket. The monopole or piles are driven anywhere from 25 to 100 ft into the seafloor (BOEM 2012a).

SAPs describe the activities (e.g., installation of meteorological towers and buoys) a lessee plans to perform for the assessment of the wind resources and ocean conditions of its commercial lease. BOEM assumes that, for each leasehold[1] projected: 0-1 meteorological towers, 1-2 buoys, or a combination, would be constructed or deployed (BOEM 2012a).

Table 3-2 presents site assessment activity associated with OCS wind energy development projects off the East coast of the U.S. There is one active wind energy lease in the area from North Carolina to Florida: Avangrid's Kitty Hawk wind farm off the coast of North Carolina and Virginia. However, there is no current site assessment activity offshore any of the South Atlantic states. Table 3-3 describes the expected site characterization and assessment activities for any future South Atlantic OCS wind energy development. It includes information on: the type of activity, its purpose, the number of events or level of activity, the primary platform (e.g., ship, barge) and its size, the scale of the activity, the sediment penetration depth, the approximate duration per event, the number of shore bases, the number of service vessels, the type of high-energy sound source used, and the extent of the bottom area disturbed.

**Table 3-2. Cumulative Effects OCS Wind Projects: Site Assessment Activities**

| Lease Number | State | Company Name | Initial Date SAP Received | Date SAP Approved | Date Deployed or to be Deployed | Facility Description |
|---|---|---|---|---|---|---|
| OCS-A 0482 | DE | GSOE I, LLC | -* | NA* | TBD | One met buoy |
| OCS-A 0483 | VA | Dominion Energy Svcs, Inc. | 5/2014 | 10/12/2017 | Q2 2019 | One met buoy |
| OCS-A 0486 | RI & MA | Deepwater Wind Rev 1, LLC | 4/1/2016 | 10/12/2017 | TBD | One met buoy |
| OCS-A 0487 | RI & MA | Deepwater Wind New England, LLC | - | NA | TBD | Two met buoys |
| OCS-A 0490 | MD | US Wind, Inc. | 11/23/2015 | 3/22/2018 | 8/2018 | One met tower |
| OCS-A 0497 | VA | VA Dept of Mines, Minerals and Energy/ Dominion Energy Svc, Inc. | 12/2014** | NA | March-October 2020 | One wave/current buoy |
| OCS-A 0498 | NJ | Ocean Wind LLC | 9/15/2017 | 5/16/2018 | 8/20/18 | Two met buoys |
| OCS-A 0499 | NJ | EDF Renewables Dev., Inc. | - | NA | TBD | TBD |
| OCS-A 0500 | MA | Bay State Wind | 12/20/16 | 6/29/17 | 7/10/17 | Two met buoys |
| OCS-A 0501 | MA | Vineyard Wind LLC | 3/31/17 | 5/10/18 | 5/22/18 | Two met buoys |
| OCS-A 0512 | NY | Equinor Wind US, LLC | 6/18/2018 | NA | TBD | Two met buoys; one wave buoy |
| OCS-A 0517 | RI & MA | Deepwater Wind South Fork, LLC | 4/1/2016 | 10/12/2017 | TBD | One met buoy |
| OCS-A 0519 | DE | Skipjack Offshore Energy, LLC | 5/24/2019 | NA | TBD | One met buoy |
| OCS-A 0520 | MA | Equinor Wind US, LLC | - | NA | TBD | TBD |
| OCS-A 0521 | MA | Mayflower Wind Energy, LLC | - | NA | TBD | TBD |
| OCS-A 0522 | MA | Vineyard Wind, LLC | - | NA | TBD | TBD |
| | | | | | | |

* Note: Site assessment activities will take place outside of the lease area. ** Note: A Research Activities Plan is submitted lieu of a Site Assessment Plan

[1] A commercial lease gives a lessee the exclusive right to seek BOEM approval for the development of the leasehold, i.e., a specific area over which BOEM grants development rights to a specific lessee. The lease does not grant the right to construct any facilities, but only authorizes the lessee to use the leased area to develop its plans. The lessee then must submit its plans to BOEM for approval before the lessee can move on to the next stage of project development.

**Table 3-3. Elements for Proposed G&G Activities in the South Atlantic Planning Area, 2012-2020**

| Activity Type | Purpose | Number of Events or Level of Activity | Primary Platform and Size | Scale of Activity | Penetration Depth | Approx. Duration/ Event | Shore Base [a] | Service Vessel | High-Energy Sound Source | Bottom Area Disturbed |
|---|---|---|---|---|---|---|---|---|---|---|
| High-Resolution Geophysical Survey | Shallow hazards assessment and archaeological determinations | One or more surveys per state | 1 ship; ~20-30 m | Each survey ≥ 1/16 OCS block [b] plus cable route to shore; total = 211,585 line-km (about 220 OCS blocks) | Surficial to 10s to 100s of meters | 3 days – 1 week | 1 | None | Boomer, sparker, or chirp sub-bottom profiler; side-scan sonar; Multi-beam depth sounder | None |
| Cone Penetrometer Test | Measure sediment engineering properties | 2,712-8,374 | 1 barge or ship, ~60 m | ≥1/16 OCS block or along cable route to shore | <10 m | <3 days | 1 | None | None | ~10 $m^2$ per sample |
| Geologic Coring | Extract sediment core | 2,712-8,374 | 1 barge or ship, ~60 m | ≥1/16 OCS block or along cable route to shore | <300 m | <3 days | 1 | None | None | ~10 $m^2$ per sample |
| Grab Sampling | Collect sediment and benthic fauna | 2,712-8,374 | 1 barge or ship, ~60 m | ≥1/16 OCS block or along cable route to shore | <1 m | <3 days | 1 | None | None | ~10 $m^2$ per sample |
| Bottom-Founded Monitoring Buoy | Measure ocean and meteorological conditions | 7-38 | 1 barge or ship, ~60 m | ≥1/16 OCS block | Surficial | <3 days | 1 | None | None | ~1 $m^2$ per buoy |
| 2D or 3D Deep Penetration Seismic | Evaluate formation for carbon sequestration | 0 to 1 survey | 1 ship, ~100 m | <1 OCS block | km to 10s of km | 1-30 days | 1 | 0-2 | Airgun array or dual array | None |

Abbreviations: COST = Continental Offshore Stratigraphic Test; FAZ = Full Azimuth Survey; N/A = Not applicable; OCS = Outer Continental Shelf; WAZ = Wide Azimuth Survey.

[a] Shore base is the point of deployment to return berth.

[b] 1/16 of an OCS block (256 ac) is the smallest area considered for renewable energy leasing. All full-build out renewable energy projects in the Mid-Atlantic and South Atlantic Planning Areas are wind park facilities that would be considerably larger than 1/16 of an OCS block. The average OCS wind park would be ≤10 OCS blocks in size.

Table 3-4 presents the projected levels of OCS wind energy development G&G activity for the Mid- and South Atlantic. The Mid-Atlantic Planning Area included the OCS offshore North Carolina. However, for this NEPA analysis, the North Carolina coast is considered as part of this South Atlantic assessment. Also, note that Table 3-4 presents state-level data including Delaware, Maryland and Virginia. These data show some 90% of the total Mid- and South Atlantic HRG surveys, cone penetrometer tests, geologic coring, and grab samples was projected in the South Atlantic, while some 60% to 75% of the bottom-founded buoys were projected in the South Atlantic. These projections also indicate about 80% of the South Atlantic G&G activity was expected to occur offshore North Carolina.

**Table 3-4. Projected Levels of G&G Activities for Renewable Energy Site Characterization and Assessment for the Mid-Atlantic and South Atlantic OCS, 2012-2020**

| Renewable Energy Area | OCS Block Equivalents | HRG Surveys [a] (max km/hours) | Geotechnical Surveys [b] | | | Bottom-founded Monitoring Buoys [c] (min-max) | Schedule |
|---|---|---|---|---|---|---|---|
| | | | Cone Penetrometer Tests (min/max) | Geologic Coring (min/max) | Grab Samples (min/max) | | |
| Delaware | 18 | 14,880/2,410 | 224–720 | 224–720 | 224–720 | 1-2 | 2012-2016 |
| Maryland | 14 | 13,030/2,110 | 196–630 | 196–630 | 196–630 | 1-6 | 2012-2017 |
| Virginia | 20 | 18,400/2,980 | 266–855 | 266–855 | 266–855 | 1-6 | 2012-2017 |
| **Total Mid-Atlantic [d]** | **52** | **46,310/75,00** | **686-2,205** | **686-2,205** | **686-2,205** | **3-14** | **2012-2017** |
| North Carolina | 354 | 327,850/53,150 | 4,956-15,930 | 4,956/15,930 | 4,956/15,930 | 1-20 | 2012-2017 |
| South Carolina | 30 | 27,830/4,510 | 420-1,350 | 420/1,350 | 420/1,350 | 1-6 | 2012-2017 |
| Georgia | 30 | 27,830/4,510 | 420-1,350 | 420/1,350 | 420/1,350 | 1-6 | 2013-2018 |
| Florida | 30 | 27,830/4,510 | 420-1,350 | 420/1,350 | 420/1,350 | 1-6 | 2013-2018 |
| **Total South Atlantic** | **444** | **411,340/66,680** | **6,216-19,980** | **6,216-19,980** | **6,216-19,980** | **4-38** | **2012-2018** |
| **Atlantic Connection Transmission Cable** | **--** | **6,600/820** | **12-24** | **12-24** | **12-24** | **--** | **2017-2020** |

[a] HRG survey effort per block was assumed to be 925 km (500 nm), requiring 150 hours to complete. Added 80 km (43 nm) and 10 hours for surveying one transmission cable route for each state (except North Carolina, which has five separate planning areas and could have five independent transmissions cables). For the Atlantic Wind Connection transmission cable, the proposed route length of 1,320 km (820 mi) was multiplied by 5 km per kilometer of route.
[b] Geotechnical survey effort was estimated to be 14-45 sampling locations per block based on the potential range of wind turbine densities per block (assuming one sampling location per turbine location). For the Atlantic Wind Connection transmission cable assumed up to 12 substations with one or two sampling locations per substation.
[c] Includes meteorological towers.
[d] The Mid-Atlantic Planning Area includes the OCS offshore Delaware, Maryland, Virginia, and North Carolina; the South Atlantic Planning Area includes South Carolina, Georgia, and Florida south to Palm Bay. These delineations do not align with the AOI for the North Atlantic and South Atlantic Cumulative Impacts Scenario documents. Activities related to offshore North Carolina have been moved from the Mid-Atlantic OCS into the South Atlantic OCS in this table and this Cumulative Impacts Scenario document.

Table 3-5 presents the vessel trips associated with OCS renewable energy and, for context, vessel activity associated with mineral mining, US naval operations, and shipping/maritime transportation. These data show vessel activity related to OCS wind energy development is a very small component (14,349 trips) of total vessel activity in the Mid- and South Atlantic, accounting for less than 3% of the >486,000 trips estimated for shipping/maritime transportation activity, for both total 2012-2020 vessel activity and average annual vessel activity.

**Table 3-5. Summary of Estimated Vessel Activity in the Area of Interest, by Activity Type**

| Vessel Activity Type | | Total, 2012-2020 | Annual Average |
|---|---|---|---|
| G&G | Seismic Airgun – port visits [a] | 125 | 14 |
| | Renewable Energy – HRG | 3,106-9,969 | 345-1,108 |
| | Renewable Energy – geotechnical | 4,255 | 473 |
| | Marine Minerals – HRG | 180 | 20 |
| | Marine Minerals – geotechnical | 93-615 | 10-68 |
| | Total G&G-related | 7,759-15,144 | 862-1,683 |
| US Navy Training, Testing, Exercises | Independent Unit Level Training | -- | 764-1,216 |
| | Coordinated Unit Level Training | -- | 118-145 |
| | Strike Group Training | -- | 46 |
| | Maintenance | -- | 475 |
| | Total Navy-related [b] | -- | 1,403-1,882 |
| Shipping/Maritime Transport | | >486,000 | >54,000 |

[a] Seismic airgun vessel port visits assumed to be approximately equivalent to seismic airgun vessel surveys.
[b] Training activities, particularly coordinated unit level training, involve multiple vessels and/or submarines

#### 3.1.1.3 Construction and Operation of Offshore Wind Facilities

Offshore wind projects are made up of wind turbine generator (WTG) foundations, scour protection, offshore service structures (OSSs) or electrical service platforms (ESPs), offshore export cable corridors, and inter-array cables. WTG foundations construction consists either of monopiles or jackets, both with a transition piece (TP). A monopile is a single, hollow steel cylinder that is secured to the seabed. The jacket design consists of three to four piles supporting a large lattice jacket structure. The TPs in both designs contain a secondary structure for mounting the WTG, a boat landing, internal and external platform, and various electrical equipment needed during installation and operation. Scour protection involves removing sediment from around the foundation by hydrodynamic forces and surrounding it with stone or rock so it can withstand increased seabed drag created by the presence of the foundation. Offshore wind farms are connected to onshore electrical grids by seabed transmission lines. The export cables are buried about 1.5 to 2.5 m beneath the seafloor. Decommissioning involves removal of above-seabed structures and submarine burial of any transmission or connection lines.

BOEM assumes proposed offshore wind projects include components, construction, operation, and decommissioning activities similar to those described above, such as wind turbines, collection cable systems, cable corridors, offshore substations, and onshore interconnection facilities.

### 3.1.2 Current Activity

As of March 2020, BOEM has 15 active commercial leases and one active research lease offshore the U.S. East Coast, which are in varying stages of development. All of these projects are in the North Atlantic except for the Kitty Hawk Offshore Wind/Avangrid project (OCS-A 0508 lease) offshore North Carolina. Currently, the Block Island Wind Farm is the only operating offshore wind facility on the U.S. East Coast. It consists of five turbines located off the southeast coast of Block Island, Rhode Island. Commercial operations started in December 2016 and the project is expected to operate for 25 years.

### 3.1.3 Reasonably Foreseeable Future Activities

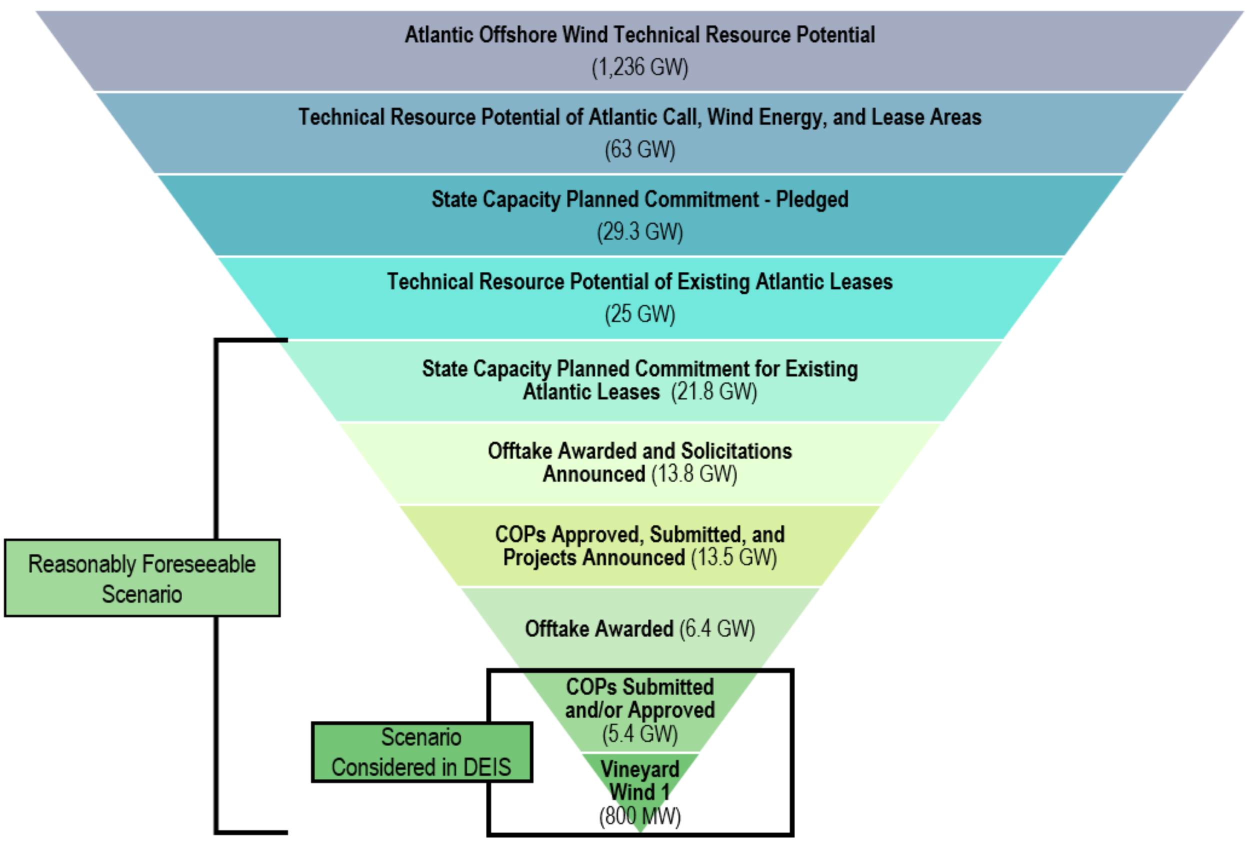
Previously, BOEM had classified the reasonably foreseeable potential of projects, sorting projects into tiers. BOEM based it tiering on a project’s stage in the leasing and permitting process, the quantity of information BOEM has about the activity, and the economic viability of the activity. However, in the summer of 2019 BOEM reconsidered the criteria it uses for classifying an action/activity as reasonably foreseeable for the purposes of the cumulative impacts scenario.

Figure 3-1 presents the possible scenarios for offshore wind development where each level is based on four factors necessary for a project to occur: resource potential, area available, demand, and level of planning. The highest level of potential offshore wind power generation is the total, technically possible resource potential of all offshore lease areas. Below this highest level, each level captures less potential offshore wind energy generation and a greater amount of available information on wind energy development projects. Note that the figures presented below for the energy generation are constantly changing; the MW values presented below should be considered as provisional estimates. The potential scope at each level is defined as described below.

*Level 1: Technical Resource Potential of Atlantic Offshore Wind.* The DOE estimate of the total technical resource potential of state and federal waters offshore Maine to Georgia for water depths less than 1,000 meters (1,236 GW; approximately that of the nation's current total electricity use).[2] BOEM does not consider this extent of OCS wind energy development as reasonably foreseeable

*Level 2: Technical Resource Potential of Atlantic Call, Wind Energy, and Lease Areas.* BOEM issues a Call for Information and Nominations to determine developer interest in proposed areas. ~~The current total energy generation for these Call Areas is 63 GW.~~ BOEM typically reduces Call Areas through its planning and leasing process following engagement with stakeholders, Tribes, and state and federal government agencies. BOEM narrows Call Areas into Wind Energy Areas (WEAs) that appear to be the most suitable for commercial wind energy development with the fewest apparent environmental and user conflicts. BOEM considers Call Areas and WEAs to be very preliminary and therefore not considered as reasonably foreseeable.

**Figure 3-1. Potential Scopes for Possible Future Development of Offshore Wind Energy**




[2] Source https://www.nrel.gov/docs/fy16osti/66599.pdf.

*Level 3: State Capacity Commitment (Planned or Pledged) for Offshore Wind.* This capacity is specific to offshore wind and does not include more general renewable or clean energy goals. Three categories of state offshore wind capacity captured at this level include awarded, announced, and planned procurements. Of these categories offtake awarded provides the greatest certainty for development, followed by announced procurements. As for planned procurements, some states require state boards or commissions to approve offshore wind procurements only if are shown to be in the public interest or the best interest of ratepayers. Thus, all the planned procurements may not be realized due to the cost of offshore wind subsidies or other reasons. An additional consideration at this level is that the state of the technology available to meet future procurements in 10 years or more may be quite different than what is planned or available today

*Level 4: Technical Resource Potential of Existing Atlantic Active Leases.* There are currently 16 active wind energy leases covering approximately 1,742,252 acres (2,056 $nm^2$) with a total technical capacity of 25 GW.[3] This capacity represents a greater offtake than currently planned by Atlantic coastal states. Significant portions of these leases could be excluded from development due to a lack of sufficient environmental data or due to state requirements. Thus, BOEM considers that the development of the maximum technical capacity of all Atlantic active leases is unlikely and is not reasonably foreseeable. This determination for OCS wind energy development also is consistent with that used for BOEM’s OCS Oil and Gas Program that similarly does not assume all areas leased will be explored and developed.

*Level 5. State Capacity Planned Commitment for Available Leases.* A state may plan for more offshore energy generation than is currently possible based on a complete buildout of the currently available lease area allocated to that state. This estimate thus includes a commitment to offshore energy generation based on the assumption of future BOEM lease sales. The current estimate from state commitments that includes lease areas in excess of currently available lease sales areas.

*Level 6: Offtake Awarded and Solicitation Announced.* A total of 13.8 GW have been awarded to meet state offshore wind procurements and 6.5 GW offtake has been announced with 11.3 GW of that total being procurements that have been both announced and awarded. This total does not include State commitments that have been planned but are not scheduled, which are captured under the planned category as described under Level 4 above.

*Level 7: Construction and Operation Plans (COPs) Approved, Submitted, and Announced.* In addition to the five COPs BOEM is currently processing (Vineyard Wind 1 and 2; Bay State; South Fork; and Empire/Boardwalk Wind), lessees have publicly announced their plans for additional projects. The capacity listed for a project corresponds to either the design envelope in their submitted COP or the size of procurements that they have publicly announced they would bid on. The total energy generation for these projects totals 13.5 GW. The developer does not always secure an offtake agreement before submitting a COP. There are examples of projects receiving offtake agreements prior to submitting a COP (e.g. Ocean Wind, Skipjack, and Sunrise). There are also examples of projects that have submitted a COP prior to securing an offtake agreement (e.g. Bay State Wind and Vineyard Wind). In terms of both the availability of information to analyze and proceed through the regulatory process, a project that has submitted a COP with no offtake agreement is more advanced than a project with only an offtake agreement and no submitted COP. The availability of information for an announced project could be as little as a company website with no specification beyond a general intention of development, to general project area location and capacity, to having a detailed submission to a procurement RFP.

[3] Industry appears to anticipate continuing the trend of increasing available turbine size over the next several years of development. The recently developed Haliade-X 12 MW turbine has a rotor diameter of 722 feet (ft), making the optimal turbine spacing for this machine approximately .83 nautical miles (nm). BOEM assumes a conservative average spacing of 1 nm with an average turbine size of 12 MW (12 MW/$nm^2$) to calculate the total 24,655 MW active lease capacity.

*Level 8: Offshore Wind Offtake Awarded*. A total of 6.4 GW has been awarded, announced, and planned (only if the plan has sufficient available lease area) to meet state offshore wind procurements.

*Level 9: Construction and Operation Plans (COPs) Submitted and Approved or COPs Submitted and Under Review by BOEM* for a total of 5.4 GW of offshore wind energy offtake.

*Level 10: Vineyard Wind Offshore Wind Energy Project.* The 800 MW wind energy development project that is the subject of the DEIS for which these revised criteria for determining reasonably foreseeable actions to include in the cumulative impact scenario.

In addition, BOEM is preparing a Supplemental Environmental Impact Statement (SEIS) in which BOEM has considered Atlantic offshore wind power generation as reasonably foreseeable based on inclusion of the following actions:

- all projects with COPs submitted or approved,
- all projects with offtake awarded,
- all projects for which the developer has publicly announced plans of development.
- additional development to fulfill the remaining announced offshore wind solicitations, and
- the more likely of the remaining planned Atlantic state solicitations.[4]

For this scenario, BOEM considers state demand as reasonably foreseeable development to the extent that the current lease area available to a state is adequate for that state's announced demand. Using this metric, it is reasonably foreseeable that the Northeast Massachusetts/Rhode Island leases will be about 73% built out. From New York to Virginia, leases will be almost completely built out to the extent that site conditions are suitable within the lease areas. North Carolina, South Carolina, Georgia, and Florida WEAs are not currently seen as reasonably foreseeable for development because there is no state demand from neighboring locations, no submitted COPs, no PPAs, nor any announced projects. Table 3-6 presents the buildup of the SEIS scenario based on the 18 listed projects for which COPs have been submitted but not approved, announced but no COP submitted, and leased with no currently announced projects.

**Table 3-6. Atlantic Offshore Wind Projects, as of April 2020**

| | Leased but Project not yet Announced | Project Announced; COP not Submitted | COP Submitted but not Approved | Approved | Notes |
|---|---|---|---|---|---|
| Liberty (MA) | | X | | | Up to 1,200 MW in bids total planned capacity; *currently no offtake* |
| Vineyard Wind 1 (MA) | | | X | | COP proposes 800 MW; MA PPA [1] |
| Vineyard Wind 2/Park City Wind (CT) | | X | | | Up to 1,668 MW in two phases total planned capacity; CT PPA for 804 MW |
| Bay State (MA) | | | X | | COP proposed 800 MW; *currently no offtake* |
| Mayflower (MA) | | X | | | 804 MW; MA PPA |
| Equinor (MA) | X | | | | *currently no offtake* |
| Sunrise (MA/RI) | | X | | | NY PPA for 880 MW |
| Revolution (MA/RI) | | X | | | RI/CT PPAs totaling 704 MW |
| South Fork (MA/RI) | | | X | | COP proposes 130 to 180 MW; NY PPA for 90 MW |

[4] ~~Approximately 5.7 GW of~~A portion of the planned solicitations for the state of New York are not included, as BOEM assumes they are reliant on additional leasing occurring in the New York Bight since it exceeds existing lease capacity.

| | Leased but Project not yet Announced | Project Announced; COP not Submitted | COP Submitted but not Approved | Approved | Notes |
|---|---|---|---|---|---|
| Empire Wind (NY)/ Boardwalk Wind (NJ) | | | X | | COP to propose up to 2,400 MW; NY PPA for 816 MW |
| Atlantic Shores (NJ) | X | | | | Developer stated capacity of lease 2,500 MW; *currently no offtake* |
| Ocean Wind (NJ) | | | X | | 1,100 MW; NJ PPA |
| Skipjack (DE) | | | X | | 120 to 192 MW; MD OREC [2] |
| US Wind (MD) | | X | | | 248 to 250 MW; MD OREC |
| CVOW (VA) | | | | X | 12 MW; research project |
| Virginia Commercial (VA) | X | | | | Developer stated capacity of lease 2,640 MW; *currently no offtake* |
| Avangrid (NC) | X | | | | *currently no offtake* |
| | | | **Subtotal: up to 13.5 GW** | | |

[1] Power Purchase Agreement [2] Offshore Wind Renewable Energy Credit
Source: BOEM 2020a

BOEM had thought offshore wind energy development would proceed linearly. However, projects have emerged with: a PPA but no publicly announced plan or COP; projects with COPs but no PPAs; projects with COPs that had more proposed development than their PPAs; and State commitments exceeding current estimated lease capacity. The current schedule of projects awarded, announced, or planned, plus state commitments are shown in Table 3-7 and total 22,687 MW. However, this estimate should be considered as only temporarily reliable because projected activity is in a constant state of flux; they should be expected to change.

Table 3-8 lists the number of projects plus procurements and additional state offshore wind energy offtake commitments at a state level for the U.S. Atlantic coastal states. Table 3-7 shows there are currently no projects or state commitments among the four South Atlantic AOI coastal states. By comparison, there are 3,154 MW and 6,140 MW projects plus commitments, respectively, in the North Atlantic and Mid-Atlantic. There also are additional state offshore wind energy commitments for 2,796 GW and 6,000 GW in the North Atlantic and Mid-Atlantic, respectively. Discounting the 4,674 MW of New York’s commitment that is in excess of current lease capacity, the result is the 18,080 MW of offshore wind energy production that BOEM now includes in its cumulative impact scenario as being reasonably foreseeable.

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**Table 3-7. Offshore Power Projects Awarded, Announced, or Planned, Plus State Commitments**

| State | <2019 | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ME | | 12 | | | | | | | | | | 12 |
| NH | | | | | | | | | | | | 0 |
| MA | 800 | | | | 800 | | 800 | | | | | 2,400 |
| RI | 430 | | | | | | | | | | | 430 |
| CT | 1108 | | | 1,196 | | | | | | | | 2,304 |
| NY [1] | 1,826 | 2,500 | | | | | | 1,200 | 1,200 | 1,200 | 1,074 | 8,326 |
| NJ | 1,100 | 1,200 | | 1,200 | | | | | | | 4,000 | 7,500 |
| DE | | | | | | | | | | | | 0 |
| MD [2] | 368 | 400 | 400 | 400 | | | | | | | | 1,568 |
| VA | 12 | | | | 880 | 880 | 880 | | | | | 2,652 |
| NC | | | | | | | | | | | | 0 |
| SC | | | | | | | | | | | | 0 |
| Total | 5,644 | 4,112 | 400 | 2,796 | 1,680 | 880 | 1,680 | 1,000 | 1,000 | 1,000 | 5,000 | 25,192 |

| | | | |
|---|---|---|---|
| Awarded: 5,644 MW | Announced: 7,308 MW | Planned but not announced or scheduled: 4,240 MW | Planned but in excess of current lease capacity: 8,000 MW |

[1] Beyond their next procurement, NY is not likely to announce additional procurements without additional leasing in the New York Bight. Therefore, development of offshore energy for New York beyond the currently announced and awarded procurements is not reasonably foreseeable at this time.
[2] In MD, the developer plans to use larger turbines and have a higher capacity than it has ORECs (Offshore Wind Renewable Energy Credit) approved. Excess electricity will most likely be sold into the open market without subsidies.

**Table 3-8. BOEM's Current Offshore Wind Development Capacity in the Cumulative Impact Scenario, as of March 2020**

| State | Projects plus Procurements, MW | Additional State Commitments, MW | Total, MW |
|---|---|---|---|
| ME | 12 | | 12 |
| MA | 1,604 | 1,600 | 3,204 |
| RI | 430 | | 430 |
| CT | 1,108 | 1.196 | 2,304 |
| NY | 1,826 | 2,500 | 4,316 |
| NJ | 1,100 | 2,400 | 3,500 |
| DE | | | |
| MD | 562 | 1,100 | 1,662 |
| VA | 2,652 | | 2,652 |
| NC | | | |
| SC | | | |
| GA | | | |
| FL | | | |
| Total | 9,294 | 8,796 | 18,090 |

Source: BOEM 2020a

As shown above, there is only one active wind energy lease in the area along the Atlantic coast from North Carolina to Florida: Avangrid's Kitty Hawk wind farm off the coast of North Carolina and Virginia. Given the current status of this effort, even with BOEM's expanded criteria for considering projects as reasonably foreseeable, BOEM does not consider this project reasonably foreseeable for purposes of defining the cumulative impacts scenario related to wind development. Regardless, the remainder of this chapter discusses the actions, activities, and IPFs that currently represent the cumulative impact scenario should offshore wind energy development occur in the South Atlantic AOI. Chapter 4 discusses both the potentially affected physical/biological/socioeconomic/cultural resources and the potential impacts associated with cumulative impacts scenario actions on these resources. Thus, Chapter 4 provides a compendium of IPFs and potential impacts to resources of the South Atlantic AOI associated with any future offshore wind energy development in the South Atlantic AOI.

### *3.1.4 Impact-Producing Factors Associated with Offshore Wind Energy*

Potential impact-producing factors (IPFs) from offshore wind energy are provided in Table 3-9.

**Table 3-9. Offshore Wind Energy Development Impact Producing Factors**

| Activity | Impact Producing Factors (IPF) |
|---|---|
| Accidental releases | fuel/fluids/hazmat<br>fuel/fluids/hazmat, structures<br>suspended sediments<br>trash and debris |
| Air emissions | onshore<br>structures, generators<br>vessels |
| Anchoring | bottom-founded structures |
| Discharges | onshore point source and non-point sources<br>structures<br>vessels |
| Electromagnetic fields | |
| Energy generation, energy security | |
| Light | structures, above water<br>vessels, above water |
| New cable emplacement/ maintenance | |
| Noise | aircraft<br>G&G<br>O&M<br>pile driving<br>turbines<br>vessels |
| Port Utilization | expansion |

**Table 3-9. Offshore Wind Energy Development Impact Producing Factors**

| Activity | Impact Producing Factors (IPF) |
|---|---|
| Presence of structures | allisions<br>entanglement, gear loss/damage<br>fish aggregation<br>habitat creation<br>migration disturbances<br>navigation hazard<br>onshore<br>seabed alterations<br>offshore, space use conflicts<br>towers<br>transmission cable infrastructure<br>turbine strikes, birds/bats<br>viewshed |
| Traffic | aircraft<br>vessels<br>vessels, collisions<br>vessel strikes, sea turtles and marine mammals |

**Microclimates**

In reviewing potential IPFs for OCS wind energy generation, consideration was given to a potential IPF that is particular to wind turbines – their potential microclimate effects. Although a demonstrated effect, studies of the nature and magnitude of microclimate impacts are sparse. Effects data in the public domain appear to be only from onshore studies.

One effect is the wake effect – the generation of a downwind turbulence field from upwind turbines that can reduce the energy production of downwind turbines (Dybas and Knoss 2018). Turbine wakes may extend up to 25 miles, potentially spanning multiple state and county jurisdictions. Using publicly available data on monthly energy generation and dominant wind direction, the researchers modeled the wake effect on a pair of West Texas wind farms, using a third wind farm as a control. They found wind speed reductions due to the establishment of an upwind farm reduced power generation at the downwind farm by 5% between 2011 and 2015, an estimated revenue loss of around $3.7 million. An example of this turbulence field is shown in Figure 3-2 at Horns Rev 1 turbines (Watts 2011). The figure presents a graphic visualization of a turbulence field created by very humid air close to its condensation point, a rare combination of meteorological conditions that has been documented only twice in 17 years of ongoing operation (Hasager et al. 2017).

The effect pf wind farms on near-surface air temperatures was examined by Roy and Traiteur (2011). They examined data from a meteorological field campaign and found reduced daytime temperatures about 2 to 3.5 degrees C and elevated nighttime temperatures of about 0.5 degrees C near the turbines (turbine height and distance downwind of tower were not provided). This effect was replicated in a modeling effort that indicated the effect was from enhanced vertical mixing due to turbulence generated by wind turbine rotors.

Another effect that can be either macro- or microclimate in nature is ice formation on rotor blades. This can occur at a macro level due to meteorological icing but can also occur at temperatures above freezing due to the cooling and condensation effect of wind turbines (see Figure 3-2). Bredesen (2017) provided a risk analysis of ice throws from rotor blades, with the primary focus of health and safety. Theoretical modeling provided a maximum throw distance of 1.5x (D+H) or about 1,100 feet. However, ice debris only has been found at 68% of the maximum throw distance (i.e., about 750 feet). Bredesen went on to calculate risk probability isopleths for serious injury or death around a turbine. However, little consideration is warranted for this phenomenon for recreational fishermen who may frequent offshore marine wind energy generating structures, which serve as fish attractants, under weather conditions expected in the South Atlantic AOI.

**Figure 3-2. Condensation in the Turbulence Field of Wind Energy Turbines**

Photograph: Christian Steiness

## Electromagnetic Fields

Another consideration in IPFs particular to offshore wind energy generation is the consideration of electromagnetic fields (EMF) generated by submarine transmission cables. Numerous species are sensitive to magnetic fields; sensitivity is highly variable even at an interspecies level. It appears the magnetic field strength of subsea cables is above the limit of detectability for sensitive species and below that for others. Impacts are difficult to characterize, e.g., attractive and repulsive to different species and at different power levels and often confounded by seabed alterations and impacts from cable burial. Representative data on EMF strength surrounding seabed cables, in microTesla (uT), for two offshore wind energy projects are as follows:

| ***South Fork*:** | | | | |
|---|---|---|---|---|
| Cable Rating | 138 kV | | | |
| Horizontal Distance (Seabed) | 0’ | 25’ | 50’ | 75’ |
| Magnetic Field, uT | 0.30 | 0.18 | 0.05 | 0.02 |
| ***Block Island:*** | | | | |
| Cable Rating | 34.5 kV | | | |
| Horizontal Distance (Seabed) | 0’ | 6’ | 40’ | |
| Magnetic Field, uT | 2.2 | 0.60 | 0.05 | |

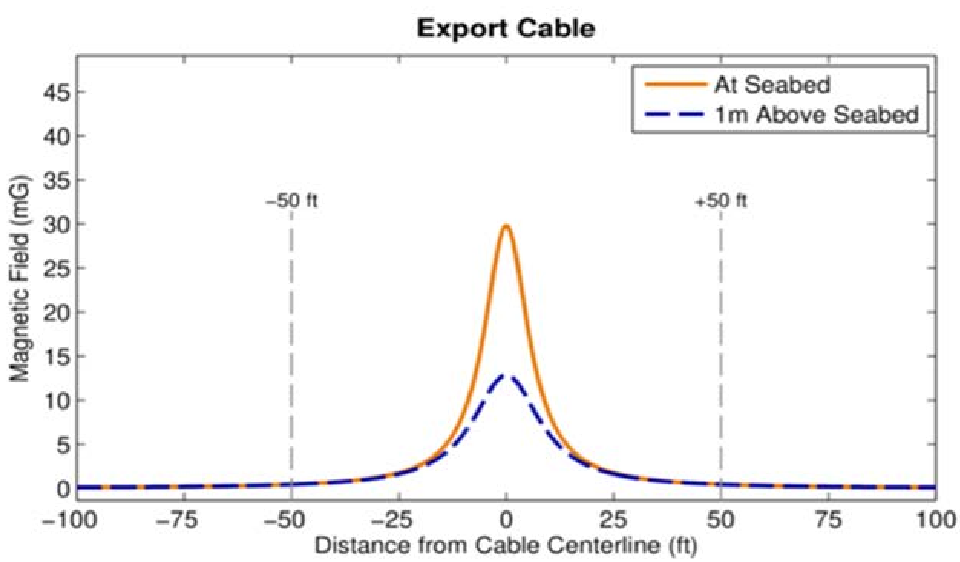
BOEM examined the impacts of EMF on commercially and recreationally species important to Southern New England (BOEM 2019f). Based on its review, BOEM concluded OCS wind energy development as currently proposed is not expected to negatively affect important fish species in the southern New England area. Negligible effects, if any, impacts are expected on bottom-dwelling species and no negative effects on pelagic species are expected. Specifically,

- AC undersea power cables associated with offshore wind energy projects within the southern New England area will generate weak EMF at frequencies outside the known range of detection by electrosensitive and magnetosensitive fishes;
- Most fishery species in the southern New England area are bony fishes, which have not evolved to detect EMF at 60 Hz;
- Pelagic have habitat preferences away from the seafloor where EMF levels are highest;
- Bottom-dwelling fishes are most likely to encounter EMF;
- The group of fishes with the greatest potential for exposure to OCS wind energy generated EMF are skates that combine electrosensitivity with a bottom-dwelling life history.

Tricas and Gill (2011) compiled field measurement and modeling data for 10 seabed transmission cables. Because many of the projects they reviewed involved single 3-core cables buried in varying depths, they created tables (Appendix Tables B-2 and B-9 through B-12 of their study) that can be used to estimate the magnetic field of AC in future projects with similar arrangements. Because the magnetic field scales linearly with line current, the tables can be used to predict the AC magnetic field at locations along and above the seabed for a cable with a known line current and a burial depth of 0.5 m, 1 m, 1.5 m, or 2 m. Similarly, another set of tables in Tricas and Gill (2011) (Appendix Tables B-7 and B-8) can be used to estimate the magnetic field of DC cables in future projects with similar arrangements to predict the DC magnetic field at locations along and above the seabed for a cable with a known line current and a burial depth of 1 m and cable separations of 0.5 m and 1 m.

Modeling of EMF strength was performed for the Deepwater Wind South Fork Wind Farm and showed a steep decline in field strength with distance from both export and inter-array. Graphical results are shown in

**Figure 3-3. Modeled EMF Field Strength for the South Fork Wind Farm Export Cable**




Source: Exponent Engineering 2018

Figure 3-3 (Exponent Engineering 2018). Magnetic field strength in the figure below is shown in milliGauss (mG), where 1 uT = 10 mG. To provide some context, the earth's magnetic field strength (NOAA, 2019) off the Atlantic coast of the U.S. ranges from approximately 51.6 uT in the Gulf of Maine to 50.6 uT near the New York Bight, to 49.9 uT off the mouth of the Chesapeake Bay.[5] From Figure 3-3, the maximum magnetic field strength directly over the cable at the surface of the seabed is about 60% that of the magnetic field strength of the earth, while at 1 meter above the seabed it decreased to about 25% that of the earth's magnetic field strength. At 50 feet laterally in either direction from the cable, the magnetic field strength declined to about 2% that of the earth's magnetic field strength.

BOEM (2018d) demonstrated that behavioral responses occur in lobsters and skates exposed to EMF from a subsea high voltage direct current (HVDC) cable. Studied behaviors included; total distance traveled, speed of movement, height from the seabed, and proportion of large turns. The effects on behavior were more strongly detected in skates than lobsters. The responses to cable EMF produced subtle but significant changes in the movement and distribution of lobsters and skates within an enclosure space placed above a subsea power cable. Although behavioral changes occurred, both species made full use of their enclosures and the EMF did not present a barrier to their movement.

For lobster tests, the EMF of the HVDC cable operated at a constant power of 330 MW, corresponding to 1,175 amps and a maximal magnetic field of 65.3 µT. During tests on skates, the cable power varied at 0, 100, and 330 MW, corresponding to 16, 345 and 1,175 amps, and magnetic fields of 51.6, 55.3 and 65.3 µT. The study also found the HVDC cables had an AC component to the EMF complicating their interpretation of skate responses. The AC electric field was well within the range of electric field levels known to attract benthic elasmobranchs (i.e., 0.5 to 1000 µV/m).

The results of the study implied there is a low likelihood of significant biological impact associated with a single cable operating at a constant 330 MW or less. The authors noted two cases where their findings may not hold: (1) cables carrying more than 330 MW, which may create an avoidance behavior; and (2) cables that carry a varying power load, which may interfere with the learning behavior of organisms that need consistency to recognize that EMF from subsea cables are not a potential source of food and not expend energy unproductively. This study also found EMF from HVDC cables varied spatially along the length of the cable as a consequence of cable properties and burial depth. If skates encountered higher intensity fields, it may lead to some level of avoidance behavior that would only present a potential impact if avoidance led to higher net energetic costs or avoidance of areas important in the life history of the species.

## 3.2 Renewable Energy – Hydrokinetic (Tidal and Wave)

### *3.2.1 Description of Action and Activities*

Current hydrokinetic energy technologies depend on the movements of river currents and ocean currents (tidal and stream) to drive a generator that converts mechanical power into electrical power. Current energy devices are often rotating machines that can be compared to wind turbines – a rotor spins in response to the movements of water currents. The rotor may have an open design like a wind turbine or may be enclosed in a duct that channels the flow. Further, the rotor may be characterized by conventional "propeller-type" blades or helical blades.

The extraction of energy from ocean currents requires a location that has strong, steady currents. The only ocean current that has these characteristics on the OCS is the Florida Current, located off the eastern coast of North America. Therefore, the analysis of ocean current energy capture technologies would be limited to impacts associated with the geographic area of the Florida Current in waters deeper than 100 m (328 ft).

[5] Based on NOAA's National Centers for Environmental Information World Magnetic Map model magnetic field strength calculator https://www.ngdc.noaa.gov/geomag/calculators/magcalc.shtml#igrfwmm Accessed 03/20/19

### 3.2.2 Current Activity

BOEM has received interest for marine hydrokinetic project proposals on the Atlantic OCS. One example of this is located in BOEM's Florida Straits Planning Area (BOEM 2014a). The site is 9-15 nm off the coast of Fort Lauderdale; bottom depths range from 860 feet to 1,201 feet. The project resulted from a research grant issued by DOE. In 2016 DOE issued $20 million in research grants, one of which was to Florida Atlantic University (FAU) establishing the South-East National Marine Renewable Energy Center (SNMREC), a federally designated research and testing center with the objective of accelerate the deployment of commercial-scale marine renewable energy recovery.

Under its jurisdictional responsibilities as specified in the OCSLA, BOEM prepared an EA to evaluate impacts associated with BOEM's leasing OCS Blocks 7003, 7053, and 7054 to SNMREC. In August 2013 BOEM released a Revised Environmental Assessment, *Lease Issuance for Marine Hydrokinetic Technology Testing on the Outer Continental Shelf Offshore Florida* (BOEM, 2013). Based on the EA, BOEM issued a Finding of No Significant Impact (FONSI) in November 2013. As a cooperating agency, DOE also issued a FONSI to evaluate the impacts of its issuing the grant in November 2013 (DOE 2013).

SNMREC was to implement the proposed project over a period of one to five years. Up to three buoys would be anchored on OCS sea floor and would disturb a maximum of 93 acres. The project would involve: exploratory geophysical, benthic, and archaeological surveys; install and maintain up to three surface buoys moored to the sea floor; tethering vessels to the buoy(s) for turbine equipment testing; towed vessel testing of turbine equipment, and collecting environmental measurements (DOE 2013).

The five-year lease, which permits SNMREC to install multiple anchored floating test berths offshore Florida, allows marine energy technology companies to test their ocean current turbine technology. In part because SNMREC is located at FAU, a Swedish developer of ocean and tidal current technology, Minesto, chose to enter an agreement with FAU. The plan called for constructing demonstration plants for commercial use in Florida to study the technical, environmental, and economic feasibility of Minesto's technology.

### 3.2.3 Reasonably Foreseeable Future Activities

The are no reasonably foreseeable future hydrokinetic projects in the South Atlantic AOI. Development could result from the SNMREC project, but technology testing and evaluation are its current activities. There are no plans for full-scale operations.

FERC currently has three licensed marine hydrokinetic projects located in Maine, New York, and Alaska, two active hydrokinetic preliminary permits located in Louisiana and California; and one pending hydrokinetic project permits in Massachusetts (FERC 2020). There are no active or pending permits or permit applications in the South Atlantic coastal states.

Currently, there are no impacts expected in the cumulative impacts scenario from tidal renewable energy development, and thus no interaction with any wind energy development IPFs. Until a reasonably foreseeable action, e.g., permitting or approval of a proposed construction plan for a tidal energy project is issued, tidal renewable energy development does not need to be included in cumulative impact analyses for wind energy development in the South Atlantic AOI. Therefore, in Chapter 4 of this document, tidal renewable energy is not discussed.

### 3.2.4 Impact-Producing Factors Associated with Tidal Energy

Potential IPFs of tidal energy projects that could overlap with offshore wind energy development include:

- Accidental releases, fuel/fluids/hazmat
- Accidental releases, trash and debris
- Air emissions, vessels
- Anchoring, bottom-founded structures
- Discharges, vessels

- Electromagnetic fields
- Energy generation, energy security
- New cable emplacement/maintenance
- Noise, vessels
- Presence of structures, disturbed hydraulics/hydrologic regimes
- Presence of structures, fish aggregation
- Presence of structures, habitat creation
- Presence of structures, migration disturbances
- Presence of structures, navigation hazard
- Presence of structures, transmission cable infrastructure
- Presence of structures, seabed alterations
- Presence of structures, offshore space use conflicts
- Traffic, vessels
- Traffic, vessel strikes, sea turtles and marine mammals.

The IPFs of tidal renewable energy, other than those that overlap with offshore wind energy development IPFs, include anchoring of bottom-founded structures and disturbed hydraulic and hydrologic regimes from the presence of structures.

## 3.3 MARINE MINERALS

### *3.3.1 Description of Actions and Activities*

Section 8(k) of the OCS Lands Act (OCSLA) and its 1994 amendments, provide BOEM the authority to negotiate an agreement for the use of OCS sand, gravel, and shell resources for shore protection and beach or coastal restoration. Using offshore sand for beach replenishment has occurred off the Atlantic coast for decades. Since 1995, BOEM has issued 26 leases for sand and gravel mining (Table 3-10). However, storms Katrina and Sandy acutely emphasized the national importance of coastal remediation and resiliency measures. Coastal erosion and storm damage seriously affected the sustainability of coastal ecosystems and economies. These two storms presented multiple challenges for tourism and coastal development, marine transportation, fisheries, energy development, and both defense and strategic infrastructure.

Dredging of OCS resources is typically performed using either a hopper dredge or a cutterhead dredge. The hopper dredge suctions the material into the hull of the dredge and brings it closer to the project area where the dredge then connects to a pipeline, that is either floating or travels along the seabed, to pump the material onshore. The Cutterhead dredge pumps material directly to the project area or onto a scow to be transferred closer to the project area. Marine mineral activities on the OCS typically include the performance of G&G surveys and dredging of sediment for use in beach nourishment and wetland restoration projects. G&G surveys may occur for two reasons. One purpose is prior to leasing during the initial sand resource exploration phase and may include surveys to map the sediment or to identify any for cultural or environmental resources. The second purpose uses on-lease surveys for borrow area monitoring, before and after dredging and construction.

**Table 3-10. Minerals Mining Lease Activity, North Carolina-Florida, 1995-Present**

| State | Lease No | Project ID | Status | Initiation Date | Original Authorized Vol (cu yd) | Total Vol w/ Amendments (cu yd) | Borrow Area |
|---|---|---|---|---|---|---|---|
| NC | OCS-A-0513 | Dare County 2016 | Complete | 9/1/2016 | 4,825,000 | 4,945,000 | Area A, Area B |

**Table 3-10. Minerals Mining Lease Activity, North Carolina-Florida, 1995-Present**

| State | Lease No | Project ID | Status | Initiation Date | Original Authorized Vol (cu yd) | Total Vol w/ Amendments (cu yd) | Borrow Area |
|---|---|---|---|---|---|---|---|
| NC | OCS-A-0523 | Carteret County 2019 | Active | 2/20/2019 | 2,000,000 | 2,000,000 | Morehead City ODMDS |
| NC | OCS-A-0491 | Carteret County 2019 | Complete | 12/12/2012 | 1,000,000 | 1,000,000 | Morehead City ODMDS |
| SC | OCS-A-0470 | North Myrtle Beach 2007 | Complete | 9/25/2007 | 702,600 | 702,600 | Little River |
| SC | OCS-A-0469 | Myrtle Beach 2007 | Complete | 9/25/2007 | 1,442,500 | 1,442,000 | Cane South |
| SC | OCS-A-0468 | Surfside Beach / Garden City 1998 | Complete | 9/25/2007 | 778,600 | 778,600 | Surfside |
| SC | OCS-A-0453 | Surfside Beach / Garden City 1998 | Complete | 12/28/1997 | 557,000 | 557,000 | Surfside |
| SC | OCS-A-0477 | Port of Charleston 2010 | Expired | 3/22/2010 | 6,000,000 | --- | East Excavation West Excavation |
| SC | OCS-A-0504 | Folly Beach 2014 | Complete | 3/31/2014 | 850,000 | 850,000 | BA-C, BA-D |
| FL | OCS-A-0479 | Duval County 2011 | Complete | 2/14/2011 | 1,200,000 | 1,200,000 | Duval Borrow Area A2 |
| FL | OCS-A-0451 | Duval County 1995 | Complete | 5/16/1995 | 1,240,000 | 1,240.000 | Duval Borrow Area A |
| FL | OCS-A-0460 | Duval County 2005 | Complete | 4/24/2005 | 900,000 | 1,500,000 | Duval Borrow Area A |
| FL | OCS-A-0511 | Duval County 2016 | Complete | 4/11/2016 | 1,394,000 | 2,400,000 | DSS |
| FL | OCS-A-0526 | Brevard County 2019 | Active | 8/28/2019 | 1,300,000 | 1,300,000 | Canaveral Shoals Borrow Area II |
| FL | OCS-A-0527 | Patrick Air Force Base 2019 | Active | 8/28/2019 | 600,000 | 600,000 | Canaveral Shoals Borrow Area II |
| FL | OCS-A-0516 | Brevard County 2018 | Complete | 10/10/2017 | 1,700,000 | 1,700,000 | Canaveral Shoals Borrow Area II |
| Fl | OCS-A-0461 | Brevard County 2005 | Complete | 1/13/2005 | 2,000,000 | 2,000,000 | Canaveral Shoals Borrow Area II |
| | OCS-A-0493 | Brevard County 2013 | Complete | 7/11/2013 | 1,730,000 | 2,400,000 | Canaveral Shoals Borrow Area II |
| FL | OCS-A-0454 | Brevard County 2000 | Complete | 7/10/2000 | 4,500,000 | 4,500,000 | Canaveral Shoals Borrow Area II |

**Table 3-10. Minerals Mining Lease Activity, North Carolina-Florida, 1995-Present**

| State | Lease No | Project ID | Status | Initiation Date | Original Authorized Vol (cu yd) | Total Vol w/ Amendments (cu yd) | Borrow Area |
|---|---|---|---|---|---|---|---|
| FL | FL-A-2000 | Patrick Air Force Base 2001 | Complete | 12/6/2000 | 600,000 | 600,000 | Canaveral Shoals Borrow Area II |
| FL | FL-A-2005 | Patrick Air Force Base 2005 | Complete | 1/27/2005 | 350,000 | 350,000 | Canaveral Shoals Borrow Area II |
| FL | OCS-A-00471 | Brevard County 2009 | Complete | 9/10/2009 | 1,300,000 | 1,300,000 | Canaveral Shoals Borrow Area II |
| FL | OCS-A-0488 | Patrick Air Force Base 2013 | Expired | 1/15/2013 | 350,000 | 350,000 | Canaveral Shoals Borrow Area II |

Source: BOEM 2019b.

Table 3-4 previously presented information related to the surveys, equipment, and level of activity/effort that BOEM projected for G&G activity for minerals mining as developed in the G&G Programmatic EIS (BOEM 2014a). Please note in this table that North Carolina was moved from the “Mid-Atlantic Planning Area,” where it resides for lease planning purposes. North Carolina along with South Carolina, Georgia, and Florida are included in the South Atlantic AOI for this NEPA document. Also note that activity in the South Atlantic represents some 90% of the total activity projected for the combined Mid- and South Atlantic.

In addition to the benthic disruption associated with sand and gravel removal, offshore minerals mining may cause impacts from HRG surveys that are needed to identify potential sand and gravel resources. Table 3-11 presents the projected level of activity and/or effort associated with HRG surveys. The table provides information on the cycle volume, water depth, distance offshore, line-kilometers (length) of HRG prospecting, line-kilometers of pre-lease surveys, and line-kilometers of on-lease surveys.

**Table 3-11. Projected Levels of HRG Surveys for OCS Sand Borrow Projects in the Mid-Atlantic and South Atlantic Planning Areas, 2012-2020**

| Year | Project | State | Cycle Volume (cubic yd) | Depth (m) | Distance Offshore (km) | Prospecting HRG [a] (line km) | Pre-Lease HRG [a] (line km) | On-Lease HRG [b] (line km) |
|---|---|---|---|---|---|---|---|---|
| **Mid-Atlantic Planning Area** | | | | | | | | |
| 2012-2013 | Wallops Island | VA | 3,200,000 | 9-24 | 18-20 | 0-0 | 0-0 | 100-501 |
| | Fort Story/Dam Neck | VA | 1,000,000 | 9-20 | 5 | 0-0 | 0-0 | 31-156 |
| | Sandbridge | VA | 2,000,000 | 9-20 | 5 | 0-0 | 0-0 | 63-313 |
| 2014-2016 | Rehoboth/Dewey | DE | 360,000 | 9-20 | 5 | 26-642 | 47-235 | 11-56 |
| | Bethany/S. Bethany | DE | 480,000 | 9-20 | 5 | 34-856 | 63-313 | 15-75 |
| | Atlantic Coast of Maryland | MD | 800,000 | 12-16 | 12-16 | 0-0 | 104-522 | 25-125 |
| | Wallops Island | VA | 806,000 | 9-24 | 18-20 | 0-0 | 0-0 | 25-126 |
| | Sandbridge | VA | 2,000,000 | 9-20 | 5 | 0-0 | 0-0 | 63-313 |
| 2017-2020 | Rehoboth/Dewey | DE | 360,000 | 9-20 | 4.8 | 0-0 | 0-0 | 11-56 |
| | Bethany/S. Bethany | DE | 480,000 | 9-20 | 4.8 | 0-0 | 0-0 | 15-75 |
| | Atlantic Coast of Maryland | MD | 800,000 | 12-16 | 12-16 | 0-0 | 0-0 | 25-125 |

**Table 3-11. Projected Levels of HRG Surveys for OCS Sand Borrow Projects in the Mid-Atlantic and South Atlantic Planning Areas, 2012-2020**

| Year | Project | State | Cycle Volume (cubic yd) | Depth (m) | Distance Offshore (km) | Prospecting HRG [a] (line km) | Pre-Lease HRG [a] (line km) | On-Lease HRG [b] (line km) |
|---|---|---|---|---|---|---|---|---|
| **South Atlantic Planning Area** | | | | | | | | |
| 2012-2013 | Patrick Air Force Base | FL | 310,000 | 3-14 | 3-8 | 0-0 | 0-0 | 10-49 |
| 2014-2016 | Grand Strand | SC | 2,300,000 | 7-13 | 4-7 | 0-0 | 0-0 | 72-360 |
| | Brevard County North Reach | FL | 516,000 | 3-14 | 3-8 | 0-0 | 0-0 | 16-81 |
| | Brevard County Mid-Reach | FL | 900,000 | 3-15 | 3-8 | 0-0 | 0-0 | 28-141 |
| | Brevard County South Reach | FL | 850,000 | 3-16 | 3-8 | 0-0 | 0-0 | 27-133 |
| | West Onslow/North Topsail | NC | 866,000 | 13-15 | 6-9 | 0-0 | 0-0 | 27-135 |
| | Bogue Banks | NC | 500,000 | 13-15 | 3-5 | 0-0 | 65-327 | 16-78 |
| 2017-2020 | Surf City/North Topsail | NC | 2,640,000 | 12-15 | 5-8 | 0-0 | 0-0 | 83-413 |
| | Wrightsville Beach | NC | 800,000 | N/A | N/A | 34-856 | 104-522 | 25-125 |
| | Folly Beach | SC | 2,000,000 | 12-14 | 5 | 0-0 | 261-1306 | 63-313 |
| | Duval County | FL | 1,500,000 | 14-19 | 10-11 | 0-0 | 0-0 | 47-235 |
| | St. Johns | FL | N/A | N/A | 3-6 | N/A | N/A | N/A |
| | Flagler | FL | N/A | N/A | 3-5 | N/A | N/A | N/A |
| **TOTAL** | | | | | | | | |
| 2012-2020 | Mid-Atlantic Planning Area | -- | 12,286,000 | N/A | N/A | 60-1,498 | 214-1,070 | 384-1,921 |
| | South Atlantic Planning Area | -- | 12,382,000 | N/A | N/A | 0-0 | 326-1,633 | 624-1,938 |
| | Unknown Projects in Mid-Atlantic Planning Areas | -- | 800,000 | N/A | N/A | 34-856 | 104-522 | 25-125 |
| | Total Mid- and South Atlantic Planning Areas | -- | 24,668,000 | N/A | N/A | 94-2,354 | 540-2,703 | 1,008-3,859 |

N/A = Not available.

[a] Prospecting and prelease HRG involve the use of subbottom profiler, side-scan sonar, bathymetry (depth sounders), and magnetometer.

[b] On-lease typically involves only a bathymetry (depth sounders).

Another important consequence of the above-described G&G activity associated with offshore minerals mining is its contribution to vessel traffic. Information on vessel activity was presented above in Table 3-5. Based on the data in that table, vessel activity related to minerals mining are a trivial component (i.e., <1%) in the total vessel activity in the South Atlantic.

States also have active minerals mining activities that support numerous beach renourishment projects. These projects may affect or be affected by offshore wind energy development projects. Assessing current or planned state level projects for marine minerals/beach renourishment or maintenance dredging, however, was confounded as there were as many different methods of reporting and types of available data as there were States involved. Evaluating the potential impacts of offshore wind energy development on local inlet, mining, and channel dredging projects appears to require real-time investigation at state- and county-level offices.

- The State of Florida Office of Resilience and Coastal Protection, Beach, Inlets, and Ports Program (BIPP) has two regional offices that oversee county-issued permits. Information is posted online, on a county-by-county basis, on Issued, Pending, and Expired Permits. Information includes both beach renourishment projects using offshore borrow area sands and dredge projects where beach quality sand is used for beach renourishment (FDEP 2020).
- The State of South Carolina Office of Department of Health and Environmental Control-Ocean & Coastal Resource Management (DHEC-OCRM) provides a GIS interactive map of completed projects that provides project sponsor, number, sand volume and source, and total costs; the state

periodically updates this information. South Caroline does not report active or pending permits (DHEC-OCRM 2020).

- North Carolina Department of Environmental Quality, Coastal Management Division was unable to provide any collected data on dredge and fill or renourishment borrow area permits. It provided an interactive GIS map of completed national renourishment projects that is supported by the American Shores & Beach Preservation Association and has data for North Carolina and Georgia projects (https://gim2.aptim.com/ASBPANationwideRenourishment/; ASBPA 2020).

The Army Corps of Engineers provides a USACE Jurisdictional Determinations and Permit Decisions website (https://permits.ops.usace.army.mil/orm-public) that contains data on CWA Section 404 dredge and fill permits for offshore and inland waters that may be the most comprehensive source of information on these local-level projects (USACE 2020).

### *3.3.2 Current Activity*

BOEM currently has active leases for OCS sand resources along the Atlantic and Gulf of Mexico coasts. Table 3-12 lists the currently active negotiated agreements, and pending requests, from North Carolina to Florida. Currently there are two active leases in the South Atlantic, both located offshore Florida.

**Table 3-12. BOEM Marine Minerals Program – Requests and Active Leases (November 2019) in the South Atlantic Area of Interest**

| **Current Requests** | | | | | |
|---|---|---|---|---|---|
| **State** | **Applicant(s)** | **Request date** | **Project Area** | **Volume Requested (Cubic Yards)** | **Borrow Area Location** |
| FL | Department of the Army/Corps of Engineers and Flagler County | 8/14/2019 | Flagler Beach | 600,000 | Borrow Area 3A |
| **Active Negotiated Agreements** | | | | | |
| **State** | **Applicant (s)** | **Agreement Expiration date** | **Project Area** | **Volume Requested (Cubic Yards)** | **Construction Status/Borrow Area Location** |
| FL | Department of the Army/Corps of Engineers and Brevard County | 8/28/2022 | Brevard County-Mid and South Reach | 1,300,000 | Not Begun |
| FL | Department of the Army Corps and Department of Air Force, 45th Space Wing | 8/28/2022 | Patrick Air Force Base segment of the Brevard County Beaches | 600,000 | Not Begun |

Source: BOEM 2019b.

There also is currently one active lease in the northern Atlantic which is located off the Virginia coast. This lease is off Virginia Beach area has an original lease volume of 2.2 million cubic yards of sand and is less than 50 km from the North Carolina border (BOEM 2019b). For more information on completed or expired leases in the North Atlantic see BOEM 2019a. Additionally there is one active negotiated agreement lease in the Sandbridge Beach, Virginia area, which is approximately 12 miles (19 km) from the North Carolina border) that has not begun and has a negotiated volume of 2.2 million cubic yards of sand (BOEM 2019b).

### *3.3.3 Reasonably Foreseeable Future Activities*

Following Hurricane Sandy, response efforts among the Atlantic coastal states and the federal government have shifted to a more proactive, regional approach to coastal resilience. BOEM and 13 coastal Atlantic states entered into cooperative agreements to perform research that will improve resilience planning efforts by finding areas for future G&G surveys to confirm previously identified resources and locate new areas of sand resources. BOEM is funding a similar effort in the Gulf of Mexico as part of an effort to create a national offshore sand inventory.

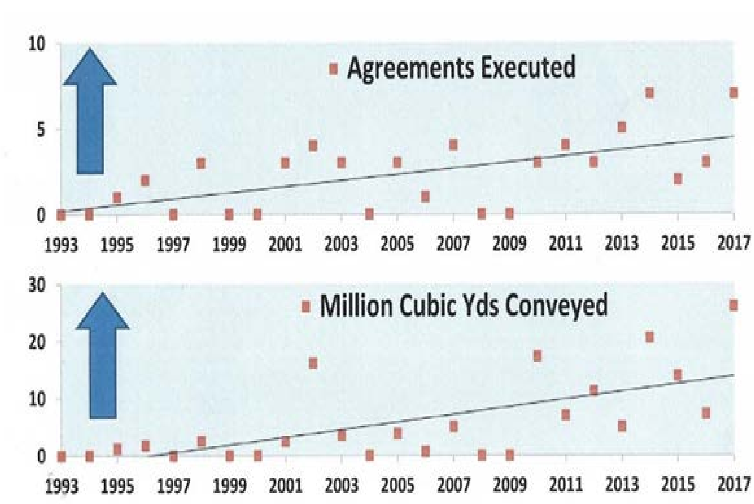
BOEM is also supporting an initiative, the Atlantic Sand Assessment Project (ASAP), using approximately $6.2 million for G&G surveys in 2015 for areas 3 to 8 nautical miles offshore, from Massachusetts to Miami, Florida. BOEM sought to find and delineate new potential OCS sand resources for potential use in coastal restoration projects. BOEM supported detailed surveys in 2016 and 2017 in specific areas offshore New York, New Jersey, and Delaware to estimate the volumes and the extent of potential new sand resources.

BOEM evaluated potential impacts from G&G surveys to map OCS sand resources and included several mitigation measures to minimize effects on environmental resources and historic properties: no air guns were used; no dredging was conducted; a marine archaeologist ensured sample locations avoided potential submerged cultural resources such as shipwrecks; and certified biological observers were onboard during all survey work to detect the presence of sea turtles and whales to implement avoidance and stoppage measures as necessary.

The ASAP will provide several benefits:

- G&G data from the inventory are compiled in a central Marine Minerals Information System that will eventually share the data through public data portals, e.g., MarineCadastre.gov and the Mid-Atlantic Ocean Data Portal.
- The inventory will help local communities recover more quickly after a hurricane or nor'easter that requires emergency coastal restoration.
- The inventory will help avoid conflicts with other potential uses, such as submarine fiber optic, electric transmission lines, and pipelines.
- The inventory will allow early coordination with other economic sectors, e.g., fisheries or recreation, to avoid or minimize potential adverse impacts.

**Figure 3-4. OCS Sand Activity, 1993-2017**




Nationally, in terms of both the annual number of requests for negotiated agreements and the annual volumes of dredge material removed (Knorr, 2017), the trend despite appreciable variability nonetheless shows consistent, moderate increases over the past 25 years (Figure 3-4). Assessments of potential interactions with sand mining within the AOI of this document must consider future sand extraction activity within the 25-year time frame of the cumulative impacts scenario.

Hurricane Sandy triggered numerous emergency management responses, e.g., multiple restorations for U.S. Army Corps of Engineers (USACE) coastal storm risk management projects. These federal projects require using OCS sediment resources to support both their short- and long-term needs. Additionally, many non-federal beach nourishment projects pursue Atlantic OCS sand resources for locally-funded efforts. Thus, there appears to be both a short-term and long-term need for utilizing OCS sand resources.

Past and currently known future sand mining activities from North Carolina to Florida for 2012 through 2020 are shown in Table 3-13. The data indicate annual volumes of dredged material to be 310,000 cubic yards for 2012 to 2013; 5.9 million cubic yards for 2014 through 2016; and 6.9 million cubic yards for 2017-2020. USACE considers the Southeast as the region most likely to see increased dredging activity as a result of preparing their ports to handle post-Panamax vessels. Thus, minerals mining activity in the South Atlantic, which increased significantly between 2012/2013 and 2014/2016, is expected to remain stable or increase somewhat through 2020.

The G&G activities associated with finding these resources will contribute no significant impact to the cumulative impacts scenario. However, sand dredging operations have the potential to interact with wind energy development activities under limited circumstances. Direct interactions may occur only within limited spatial and temporal conditions. Both project-level dredging activities and wind energy construction and installation activities are usually relatively short-term efforts−one or two years.

The likelihood of dredging for a series of projects resulting in longer-term impacts, however, is possible. Also, the direct impacts arising from seafloor disturbances have relatively limited potential for spatial interactions, on the order of kilometers. The interactions most likely to occur with wind energy development projects will occur from seafloor disturbances that affect mobile populations, e.g., certain demersal fishes, sea turtles, or marine mammals, which could be exposed to the seabed impacts of both dredging and wind energy structure construction and installation.

**Table 3-13. Projected Sand Borrow Projects, North Carolina to Florida**

| Year | State | Volume, cu yd |
|---|---|---|
| 2012-2013 | FL | 310,000 |
| | Total | 310,000 |
| | Annual | 155,000 |
| 2014-2016 | SC | 2,300,00 |
| | FL | 516,000 |
| | FL | 900,000 |
| | FL | 850,000 |
| | Total | 4,566,000 |
| | Annual | 1,522,000 |
| 2017-2020 | SC | 2,000,000 |
| | FL | 1,500,000 |
| | Total | 3,500,000 |
| | Annual | 875,000 |
| 2012-2020 | Total | 8,376,000 |
| | Annual | 930,667 |

Source: BOEM 2014a

### *3.3.4 Impact-Producing Factors Associated with Marine Mineral Activities*

IPFs of OCS marine minerals mining that may overlap with impact producing factors associated with offshore wind energy development include:

- Accidental releases, fuel/fluids/hazmat, vessels
- Accidental releases, trash and debris
- Discharges, vessels
- Noise, O&M
- Traffic, vessel strikes, sea turtles and marine mammals
- Traffic, vessels.

OCS minerals mining IPFs that do not overlap with offshore wind energy include:

- Gear utilization, dredging
- Seabed profile alterations.

## 3.4 DREDGED MATERIAL OCEAN DISPOSAL

### *3.4.1 Description of Actions and Activities*

Prior to 1972, ocean dumping in ocean waters of the U.S. was unregulated and included materials such as petroleum products, acid chemical wastes, and other industrial wastes, and heavy metals in industrial wastes; organic chemical wastes; contaminated and uncontaminated dredged material; sewage sludge; construction and demolition debris; and containers of radioactive wastes. The Marine Protection, Research and Sanctuaries Act (MPRSA) was enacted in 1972 and regulated the dumping of materials into the marine environment and implemented the London Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter. Four agencies have responsibilities under MPRSA: EPA has primary authority for regulating ocean disposal of all materials except dredged materials; USACE and EPA share responsibilities for regulating ocean disposal of dredged material; USCG maintains surveillance of ocean dumping; and NOAA is responsible for certain long-range research efforts. EPA Regional offices are responsible for designating and managing ocean disposal sites. USACE issues permits for ocean disposal sites and all ocean sites for the disposal of dredged material are permitted or authorized under MPRSA. Currently, the vast majority of material disposed in the ocean is uncontaminated sediment (dredged material).

### 3.4.2 Current Activities

There are 8 active projects and 8 inactive/closed projects identified in the South Atlantic coastal states (North Carolina to Florida; Table 3-14; USACE 2019). Between 1976 and 2016 of the 3,273 disposal events at 125 sites, 319 dredged material disposal events occurred at 74 disposal sites in the South Atlantic (Ocean Disposal Database USACE 2019).

**Table 3-14. Ocean (Dredge Material) Disposal Sites, North Carolina through Florida**

| Site ID | Status | Usage | Disposal Volume (cu yd) | Disposal Area ($nm^2$) |
|---|---|---|---|---|
| Morehead City, NC | Active | 1987-2016<br>1987- * | 14,324,967 | 8.0<br>8.0* |
| New Wilmington, NC | Active | 2002-2016<br>2002- * | 29,907,445 | 9.4<br>9.4* |
| Charleston, SC | Active | 1976-2016<br>1987- * | 67,806,581 | 7.4<br>7.4* |
| Savannah, GA | Active | 1976-2016<br>1987- * | 39,413,722 | 4.26<br>4.26* |
| Brunswick Harbor, GA | Active | 1976-2016<br>1989- * | 33,800,221 | 2.0<br>2.0* |
| Fernandina Beach, FL | Active | 1976-2016<br>1987- * | 41,489,126 | 4.0<br>4.0* |
| Jacksonville, FL | Active | 1976-2015<br>1984- * | 21,496,883 | 4.56<br>4.56* |
| Canaveral Harbor, FL | Active | 1976-2016<br>1990- * | 26,495,154 | 4.0<br>4.0* |
| Morehead City, NC | Inactive | 1976-1992 | 10,533,190 | 8.0 |
| Wilmington Harbor, NC | Inactive | 1965-1984 | 11,142,500 | 2.3 |
| Wilmington, NC | Inactive | 1987-2008<br>1987- * | 41,308,210 | 2.3<br>2.3* |
| Georgetown, Harbor, SC | Inactive | 1976-2006<br>1988- * | 7,229,700 | 1.0<br>1.0* |
| Port Royal Harbor, North, SC | Inactive | 1976-1995 | 2,157,400 | 0.8 |
| Port Royal Harbor, South, SC | Inactive | 1977-1995 | 2,659,100 | 1.0 |
| Port Royal, SC | Inactive | 1998-2003<br>2005- * | 525,300 | 1.0<br>1.0* |
| St. Augustine Harbor #1, FL | Inactive | 1976-1977 | 300,700 | 0.0 |

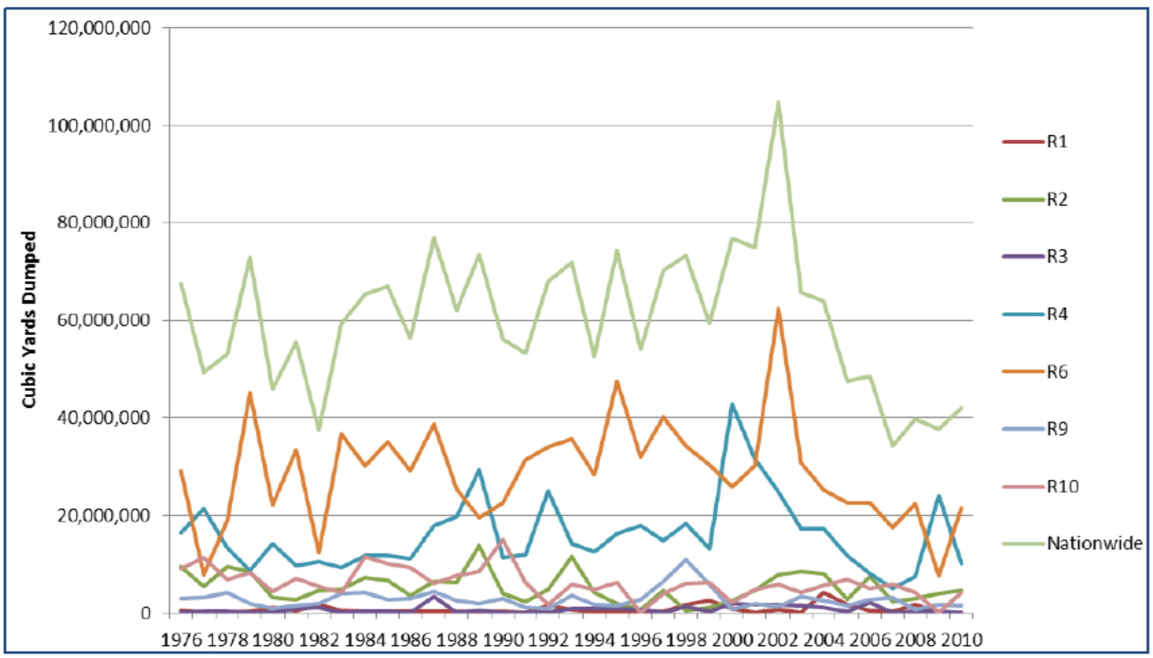
Source: USACE 2019.
*Source: EPA data from interactive Ocean Dumping: Disposal Sites and Vessel Disposals Map

There also are two active disposal sites in the Norfolk and Dam Neck, Virginia areas that could potentially interact with OCS wind energy development in the northern portion of the South Atlantic. These areas are approximately 100 km from the North Carolina border. Between 1981-2015, these sites in southern Virginia waters had a disposal volume of 23.3 million cubic yards (BOEM 2019a).

### 3.4.3 Reasonably Foreseeable Future Activities

Because ocean disposal currently consists of dredged material disposal, the activity level of ocean disposal directly follows dredge spoil generation. EPA noticed a trend in ocean disposal of dredge material that showed decreases in ocean dumping and increased focus on beneficial reuse (EPA 2012). Ocean dumping of many types of substances has been phased out since MPRSA was enacted in 1972. Dredged material from navigation channels is now the predominant substance disposed of through ocean dumping. Figure 3-5 shows that on a national level, there was a pronounced decline in ocean dumping of dredged material starting in the early 2000s by some 60%, with a record low in 2007. Since 2007, however, the national trend appears to have reversed with a slight (8%) increase in disposed material. The national trend notwithstanding, dredged material disposal in EPA Region 4 (Alabama, Florida, Georgia, Kentucky, Mississippi, North Carolina, South Carolina, and Tennessee) is exceeded only by EPA Region 6 (Arkansas, Louisiana, New Mexico, Oklahoma, and Texas) and although Region 4 generally following the national trend it showed a pronounced increase in 2009, making a trend prediction uncertain.

**Figure 3-5. Ocean Disposal Trends, 1976-2010 by EPA Region and Nationally**




Source: EPA 2012

Nationally, ports are undergoing major harbor and channel deepening projects as they seek to accommodate post-Panamax vessels. USACE has identified the Southeast coast ports as top candidates for economically justified port expansion/dredging projects (USACE 2012). USACE considered the potential for somewhat greater environmental impact from dredging in the Southeast Atlantic for several reasons. Freight transport is expected to grow most rapidly in that region; a high regional population growth rate is expected; more harbor expansion is needed to accommodate post-Panamax vessels; and greater wetland and endangered species vulnerability could result in higher environmental impact mitigation costs.

EPA has encouraged beneficial reuse or land disposal rather than ocean dumping where feasible or necessary to protect marine habitats. USACE reported that about 20% to 30% of port and waterway dredged material is used for habitat creation and other beneficial use (USACE 2012). EPA also noted a connection between climate change, sea level rise, and beneficial reuse. EPA is increasingly reviewing projects where sediments are proposed for beneficial reuse as protective measures for repairing dikes and providing sandy sediments for coastal areas for infrastructure protection (EPA 2012).

Given the dynamic tension between increased port channel-related dredging activity and increased use of dredge spoil for beneficial uses, ocean disposal activity in the South Atlantic is expected to remain stable or increase somewhat.

### 3.4.4 Impact Producing Factors Associated with Dredged Material Ocean Disposal

Potential impact producing factors of dredged material ocean disposal that may interact with those for wind energy development include:

- Accidental releases, fuel/fluids/hazmat
- Accidental releases, trash and debris
- Air emissions, vessels
- Discharges, vessels
- Noise, vessels
- Traffic, vessel strikes, sea turtles and marine mammals
- Traffic, vessels.

Dredged material ocean disposal IPFs that will not materially overlap wind energy development include:

- Beach restoration, improved coastal/dune habitat
- Port utilization, maintenance, dredging
- Sediment deposition and burial.

## 3.5 Military Ranges and Civilian Space Program Uses

### 3.5.1 Description of Activities

There are numerous areas off the Atlantic Coast where military and space program activities are occurring. Military activities occurring in the South and Mid-Atlantic coastal area from North Carolina to Florida include various testing, training, and operational missions conducted by the U.S. Navy (Navy), Marine Corps, the U.S. Air Force (Air Force), the U.S. Coast Guard (USCG), and Special Operations Forces among others. Military vessels use surface and subsea areas for training and testing activities. Military aircraft test and train within special use airspace overlying the coast and in offshore warning areas.

With respect to the OCS area, the following mission readiness activities are occurring (Secretary of Defense 2018):

- Navy use of airspace, sea surface, sub-surface and seafloor of the OCS for events ranging from instrument equipment testing to live-fire exercises; and

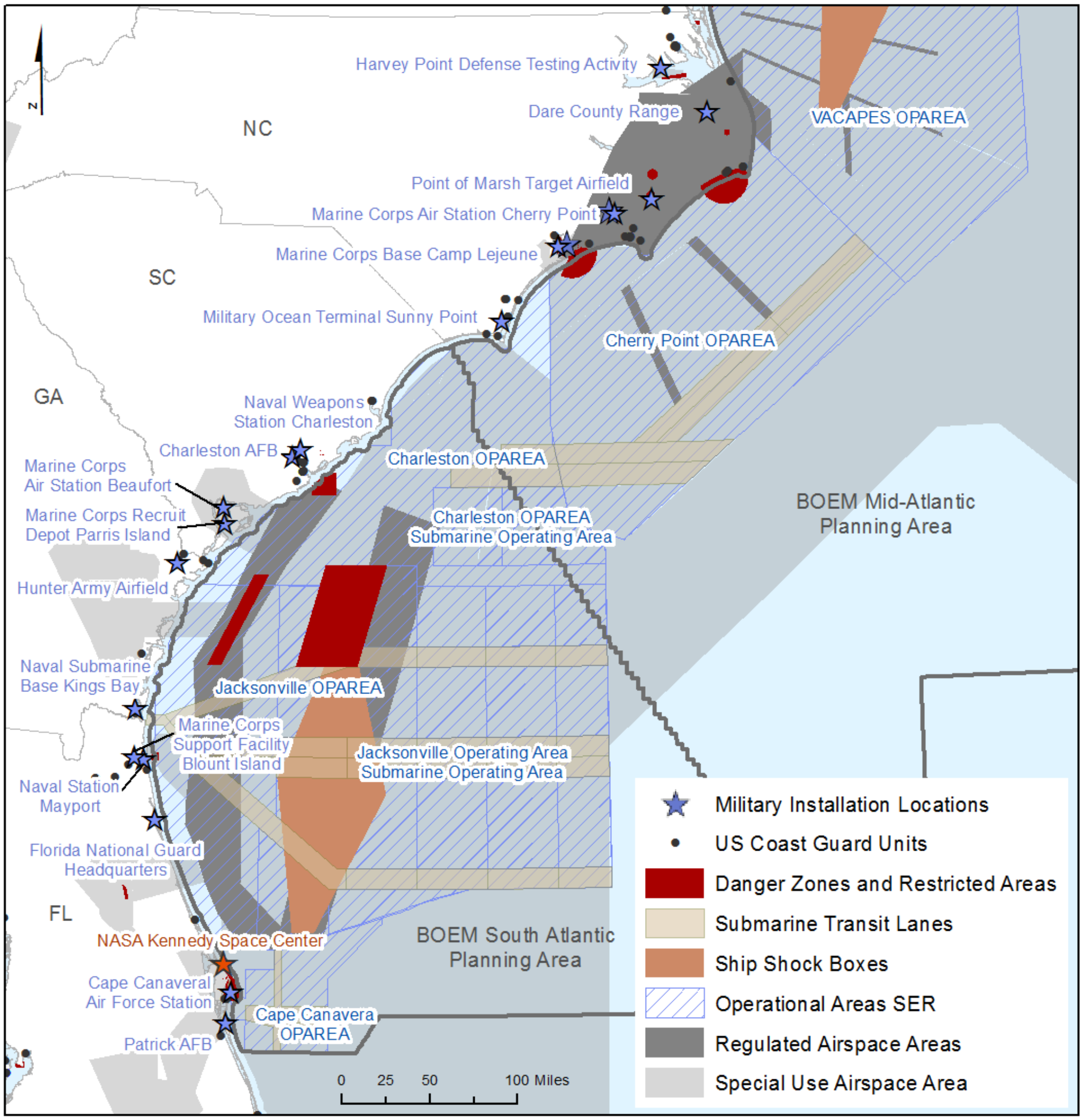
- Marine Corps amphibious warfare training.

The Navy, USCG, Air Force, and Air National Guard are also responsible for search and rescue missions on the Atlantic coast, which may involve the use of low flying aircraft and helicopters offshore. The Navy, the USCG, and other military entities also operate onshore facilities along this portion of the Atlantic coast that often support offshore activities. Major onshore installations are shown on the map in Figure 3-6. As illustrated on the map, in addition to 16 military facilities, there are a number of USCG stations along the Atlantic coast from North Carolina to Florida.

Areas where training and testing of military platforms, tactics, munitions, explosives, and electronic warfare systems occur are designated as "range complexes," which provide controlled environments where military ship, submarine, and aircraft crews can train in realistic conditions while safely deconflicting with non-military activities, such as civilian shipping and aircraft. However, these are not areas over which the Navy has exclusive control. In cases where naval vessels and aircraft conduct operations that are not compatible with commercial or recreational activities, they are confined to Operating Areas (OPAREAs) away from commercially used waterways and inside Special Use Airspaces (SUA). Hazardous operations are communicated to all vessels and operators by use of Notices-to-Mariners issued by the USCG and Notices-to-Airmen issued by the FAA. Figure 3-6 illustrates OPAREAs and SUAs along the Atlantic coast from North Carolina to Florida.

In addition, the National Aeronautics and Space Administration's (NASA's) John F. Kennedy Space Center (KSC) is located on Florida's eastern shore. In recent years, KSC has established a partnership with the Cape Canaveral Air Force Station. The two facilities are jointly referred to as the Cape Canaveral Spaceport. This area is a multiuser spaceport that supports both the U.S. government and commercial customers in scientific, technological, and educational flight projects and uses Atlantic waters for operations (NASA 2013). The KCS has played a pivotal role in fulfilling national space and defense priorities and programs. The facility served as the departure site for the first human expedition to the moon; the base for several Space Shuttle launch and landing operations; and as a space for hundreds of scientific and commercial spacecraft research projects (NASA 2017). NASA has designated downrange danger zones and has identified patterns for recent debris cones from rocket tests that represent hazards for surface activities after such tests. There also are restricted areas for rocket testing, satellite launches, and other range mission activities (BOEM 2014a).

**Figure 3-6. Military uses of South Atlantic Region**




Source: Department of Defense, USGS, USCG, BOEM

As illustrated in Figure 3-6, the various types of offshore areas used by the military include (Mid-Atlantic Ocean Data Portal 2018):

- **Danger Zones and Restricted Areas**: The Code of Federal Regulations (CFR) defines a Danger Zone as, "A defined water area (or areas) used for target practice, bombing, rocket firing, or other especially hazardous operations, normally for the armed forces. The danger zones may be closed to the public on a full-time or intermittent basis, as stated in the regulations." The CFR defines a Restricted Area as, "A defined water area for the purpose of prohibiting or limiting public access to the area. Restricted areas generally provide security for Government property and/or protection to the public from the risks of damage or injury arising from the Government's use of that area."

- **Submarine Transit**: Areas where submarines may navigate underwater, including transit corridors designated for submarine travel.
- **Ship Shock Boxes**: A location, which is not considered a Military Range, where ship shock trials (explosives are detonated underwater against surface ships) can be conducted by Naval Sea System Command on new classes of Navy ships.
- **Operating Areas**: The bounded area in which national defense training exercises and system qualification tests are routinely conducted.
- **Regulated Airspace**: Regulated airspace areas depict the Air Traffic Control Assigned Airspace and Airspace Corridor areas.
- **Special Use Airspace**: Limitations may be imposed upon aircraft operations that are not a part of the airspace activities. Special use airspace includes any associated underlying surface and subsurface training areas.

### 3.5.2 Past and Present Activities

As shown above in Figure 3-6, there are multiple military and civilian space facilities along the Atlantic coast from North Carolina to Florida. Military entities operating out of these facilities conduct activities in the offshore region from North Carolina to Florida. Table 3-15 summarizes these activities. In addition, there are military facilities located just north of the North Carolina border (e.g., the Norfolk Naval Station), that may conduct activities in the South Atlantic AOI. that may be important to consider; these activities are summarized in BOEM 2019a.

**Table 3-15. Existing Military Activity Occurring Offshore from North Carolina to Florida**

| Activity | Description | Area of Activity |
|---|---|---|
| U.S. Navy Atlantic Fleet Training and Testing | Training activities and research, development, testing, and evaluation activities (also referred to as "military readiness activities"). These military readiness activities include the use of active sonar and explosives within existing range complexes and testing ranges. In addition, the Naval Submarine Base at Kings Bay (GA) manages and operates the Atlantic Fleet's Ballistic and Guided Missile Submarines, amounting to $32 billion worth of submarine and missile infrastructure. | High seas areas located in the Atlantic Ocean along the eastern coast of North America; deep sea submarine transit lines; at Navy pier side locations; within port transit channels; near civilian ports; and in bays, harbors, and inshore waterways |
| U.S. Coast Guard Activities | USCG performs maritime humanitarian, law enforcement, and safety services in estuarine, coastal, and offshore waters. Training and mission activities include boat and ship exercises; fixed-wing aircraft and helicopter activities; gunnery, including munitions and other expendables such as signal flares and marine markers; and the use of high frequency and ultra-high frequency sonar detection systems. | U.S. Coast Guard District 5 (New Jersey to North Carolina) and District 7 (South Carolina to Florida) |

**Table 3-15. Existing Military Activity Occurring Offshore from North Carolina to Florida**

| Activity | Description | Area of Activity |
|---|---|---|
| U.S. Air Force Activities | The 45th Operations Group at the Cape Canaveral and Patrick Air Force Bases launch space vehicles for the Department of Defense, NASA, and international commercial customers. They are responsible for fulfilling satellite systems directorates for National, Civil, and Combatant Commander requirements. Other Air Force bases along the Southeast coast conduct regular fixed-wing aircraft and helicopter activities. | Cape Canaveral Air Force Station and Patrick Air Force Base, Florida; Air space off the coast of North Carolina-Florida (e.g. Charleston Air Force Base, South Carolina) |
| U.S. Marine Corps Activities | Blount Island is responsible for Marine Corps Maritime Prepositioning Ships Maintenance Cycle operations and oversight of the Marine Corps Prepositioning Program. Activities at Camp Lejeune include amphibious training, gunnery, operational planning, and air combat support. | Blount Island Command, Jacksonville, Florida; Camp Lejeune, Jacksonville, North Carolina |
| U.S. Marine Corps - Air Station Activities | Marine Corps Air Station activities include aviation logistics support, planning, and training; interception and destruction of enemy aircraft; and logistic support for the U.S. Navy. | Air space off the coast of North Carolina-Florida (e.g. Cherry Point Air Station, North Carolina; Beaufort Air Station, South Carolina) |
| U.S. Army Activities | The Sunny Point terminal is used in the import and export of weapons, ammunition, explosives, and military equipment for the U.S. Army. The Hunter Army Airfield is frequently used for the deployment of soldiers and cargo via fixed-wing aircraft and helicopters. | Military Ocean Terminal Sunny Point, North Carolina; Hunter Army Airfield, Savannah, Georgia |
| National Aeronautics and Space Administration | NASA has designated downrange danger zones and restricted areas that include hazard and debris areas from rocket tests, satellite launches, and other range mission activities. | Offshore from Kennedy Space Center, Florida |

Source: BOEM 2014a, NPS 2017, Navy 2018, Navy 2019, Tetterton 2006, U.S. Air Force 2016, U.S. Department of Defense 2019, U.S. Marine Corps 2019a-d

### 3.5.3 Reasonably Foreseeable Future Activities

In the near term, it is likely that the level of military activity will remain relatively stable in this region. Military activities in at-sea training ranges have remained steady over the past 10 years (NRPB 2015). However, a recent report on Sustainable Ranges (Secretary of Defense 2018) indicated that fiscal trends are placing pressure on sustaining resources for instrumentation, range operation, and manpower. Thus, there is some uncertainty and it is difficult to predict the levels of military use of the range complexes in the future.

Civilian space program uses in the region may increase above the present level, given planned future operations at the Kennedy Space Center. KSC's Master Plan Implementation Strategy aims for growth of KSC as a multi-user spaceport, supporting government, commercial, and academic endeavors (NASA 2018).

### 3.5.4 Impact-Producing Factors Associated with Military Uses and Civilian Space Program Uses

The following reasonably foreseeable impacts of military uses along the Atlantic coast from North Carolina to Florida that may overlap with offshore wind energy development IPFs include the following:

- Accidental releases, fuel/fluids/hazmat
- Accidental releases, trash and debris
- Air emissions, aircraft
- Air emissions, vessels

- Discharges, vessels
- Light, structures, onshore
- Noise, aircraft
- Noise, pile driving
- Noise, vessels
- Presence of structures
- Presence of structures, onshore
- Traffic, aircraft
- Traffic, vessel strikes, sea turtles and marine mammals
- Traffic, vessels.

Additional IPFs from military activities that may not overlap with offshore wind energy IPFs include:

- Anchoring, bottom-founded structures
- Demolition/structure removal
- Energy stressors/devices/lasers, EM devices, high energy lasers
- Gear utilization, dredging
- Guidance/fiber optic wires, entanglement
- Ingestion, expended materials
- Noise, explosives, weapons
- Noise, sonar.

## 3.6 Marine Transportation, Navigation, and Traffic

### *3.6.1 Description of Action and Activities*

Marine transportation in the South Atlantic region is diverse, with vessels originating from numerous ports and private harbors within the South Atlantic, as well as elsewhere in the U.S and internationally. Commercial traffic in the South Atlantic includes commercial fishing, passenger vessels (e.g., cruise ships, ferries), cargo, tug/barge, liquid tanker, military or military training, research, dredging/underwater/diving operations, and search-and-rescue vessels. Recreational traffic includes pleasure, sailing, charter, recreational fishing, and high-speed craft (USCG 2007). Additional discussions of commercial and recreational fishing activities are presented in Section 3.7.

Shipping fairways, traffic lanes, anchorage areas, separation, danger, and safety/security zones, and other navigational features designated to provide safe access routes to and from U.S. North and Mid-Atlantic ports are illustrated in Figure 3-7. Data layers of these navigational features are available in the Marine Cadastre Data portal, a data clearinghouse maintained by NOAA and BOEM (NOAA & BOEM 2018). The portal includes data for the North, Mid-Atlantic and South Atlantic regions.

### *3.6.2 Past and Present Activities*

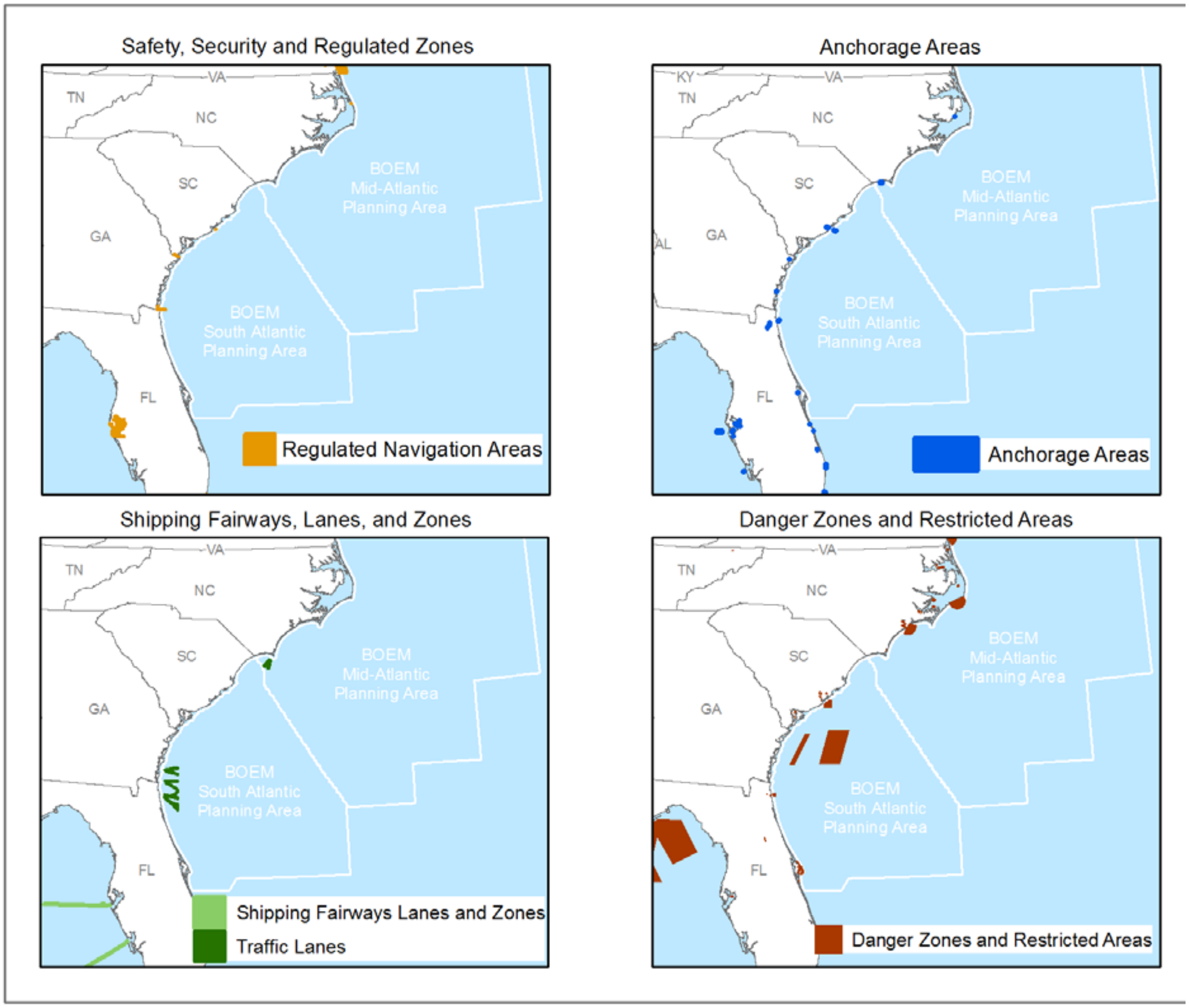
Commercial transit routes are numerous and varied, as illustrated with Automatic Identification System (AIS) data from 2017 (Figure 3-8).[6] AIS data are available from the Marine Cadastre data portal.

In 2015, 7,700 commercial vessel calls were made at ports and terminals in the South Atlantic (Table 3-16). The busiest in the region were Savannah, Charleston, Brunswick, Wilmington, and Jacksonville ports. (Section 3.11, Land Use and Coastal Infrastructure, provides additional information on ports.) Container, roll-on/roll-off (RO-RO) and tankers vessels were the most common in that order. Vessel call volume remained relatively steady from 2006 to 2015, with no discernible trend, as illustrated in Table 3-17 for all

[6] NOAA OCM 2019. This dataset represents annual vessel transit counts summarized at a 100 m by 100 m geographic area. A single transit is counted each time a vessel track passes through, starts, or stops within a 100 m grid cell.

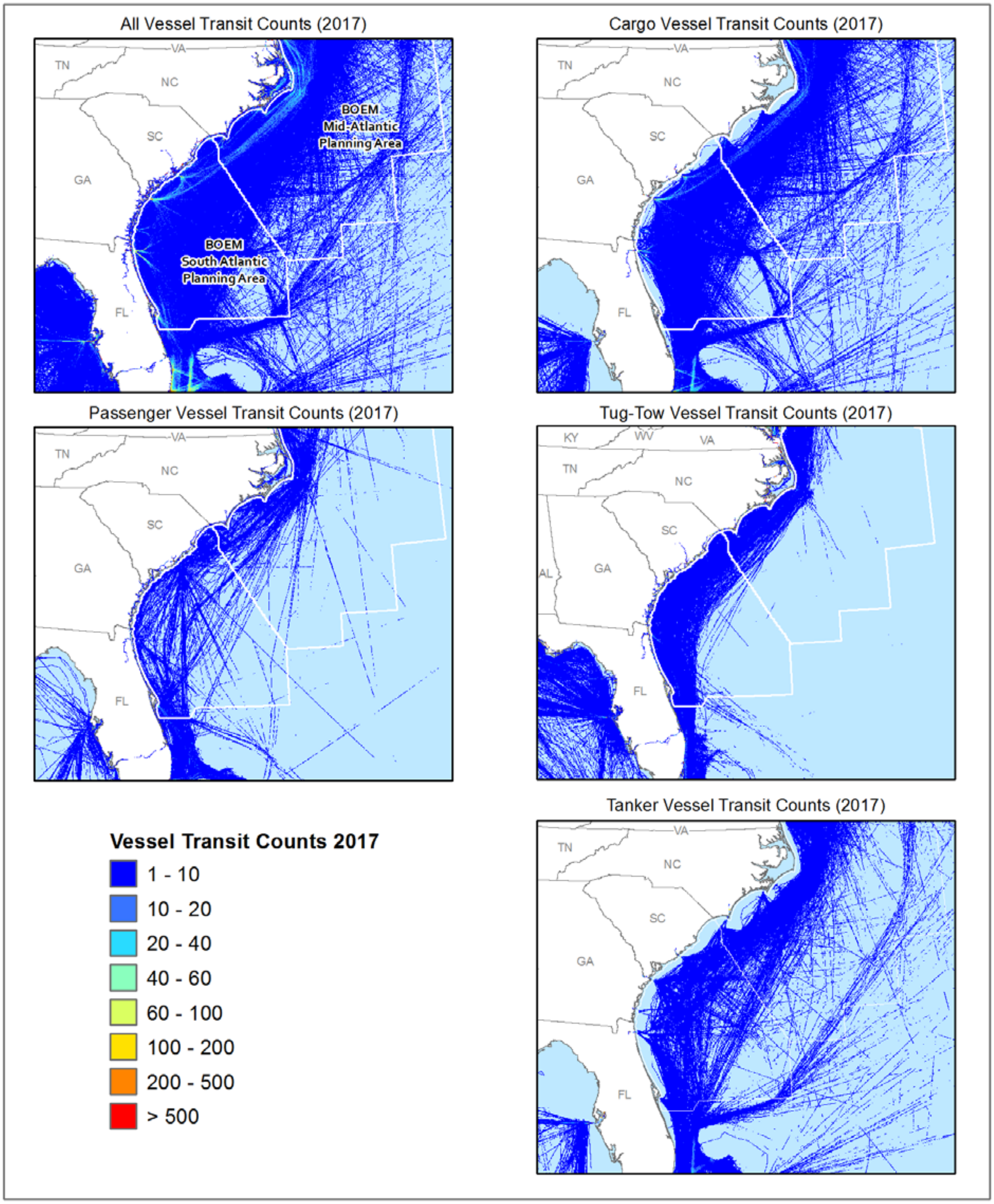
ports and terminals in the South Atlantic and in Figure 3-9 for the five busiest South Atlantic ports and terminals.

**Figure 3-7. Designated Navigation Features of the South Atlantic**




Source: BOEM & NOAA 2018

**Figure 3-8. 2015 Commercial Vessel Transit Counts in the South Atlantic**




Source: BOEM & NOAA 2018

**Table 3-16. 2015 Vessel Calls in Selected Ports and Terminals in the South Atlantic**

| Port | Grand Total | Container | Dry Bulk | Gas | General Cargo | RO-RO | Tanker |
|---|---|---|---|---|---|---|---|
| Savannah, GA | 2,620 | 1,856 | 198 | 4 | 181 | 181 | 200 |
| Charleston, SC | 2,069 | 1,477 | 68 | - | 140 | 243 | 141 |
| Jacksonville, FL | 1,563 | 424 | 121 | - | 149 | 727 | 142 |
| Brunswick, GA | 646 | - | 57 | - | 62 | 522 | 5 |
| Wilmington, NC | 508 | 237 | 52 | - | 73 | 26 | 120 |
| Port Canaveral, FL | 178 | 1 | 29 | - | 49 | 18 | 81 |
| Morehead City, NC | 117 | - | 18 | - | 68 | - | 31 |
| **Grand Total** | **7,702** | **3,995** | **543** | **4** | **722** | **1,718** | **720** |

Source: MARAD 2019

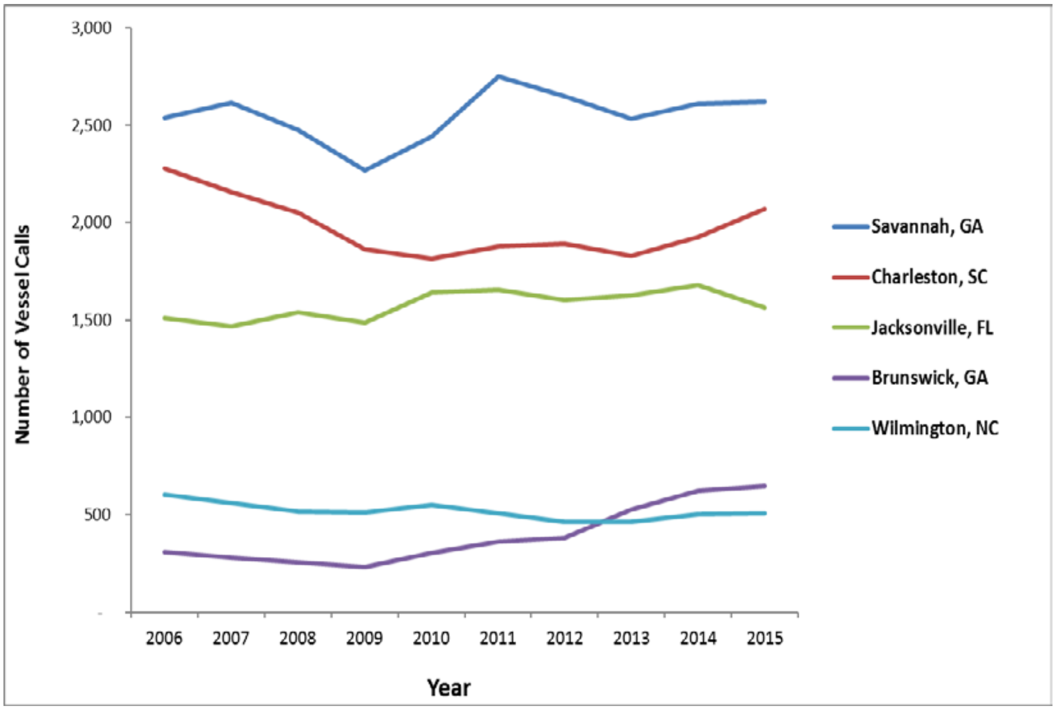
**Table 3-17. Vessel Calls in Selected Ports in the South Atlantic, 2006-2015**

| Port | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 |
|---|---|---|---|---|---|---|---|---|---|---|
| Savannah, GA | 2,540 | 2,614 | 2,476 | 2,270 | 2,443 | 2,753 | 2,650 | 2,533 | 2,613 | 2,620 |
| Charleston, SC | 2,280 | 2,159 | 2,053 | 1,865 | 1,817 | 1,876 | 1,893 | 1,831 | 1,924 | 2,069 |
| Jacksonville, FL | 1,513 | 1,466 | 1,542 | 1,486 | 1,641 | 1,657 | 1,601 | 1,625 | 1,679 | 1,563 |
| Brunswick, GA | 307 | 282 | 255 | 231 | 304 | 364 | 383 | 525 | 624 | 646 |
| Wilmington, NC | 602 | 560 | 515 | 514 | 550 | 507 | 462 | 462 | 503 | 508 |
| Port Canaveral, FL | 61 | 56 | 10 | 8 | 38 | 83 | 6 | 175 | 180 | 178 |
| Morehead City, NC | 34 | 25 | 20 | 50 | 84 | 77 | 97 | 59 | 104 | 117 |
| Fernandina, FL | 10 | 2 | 1 | 6 | 3 | 85 | 53 | 0 | 5 | 1 |
| Georgetown, SC | NR | NR | NR | NR | NR | NR | NR | 0 | 2 | 0 |
| **Grand Total** | **7,347** | **7,164** | **6,872** | **6,430** | **6,880** | **7,402** | **7,145** | **7,210** | **7,634** | **7,702** |

NR = Not reported

Source: MARAD 2019

**Figure 3-9. Vessel Calls at the Five Busiest Ports in the South Atlantic, 2006-2015**



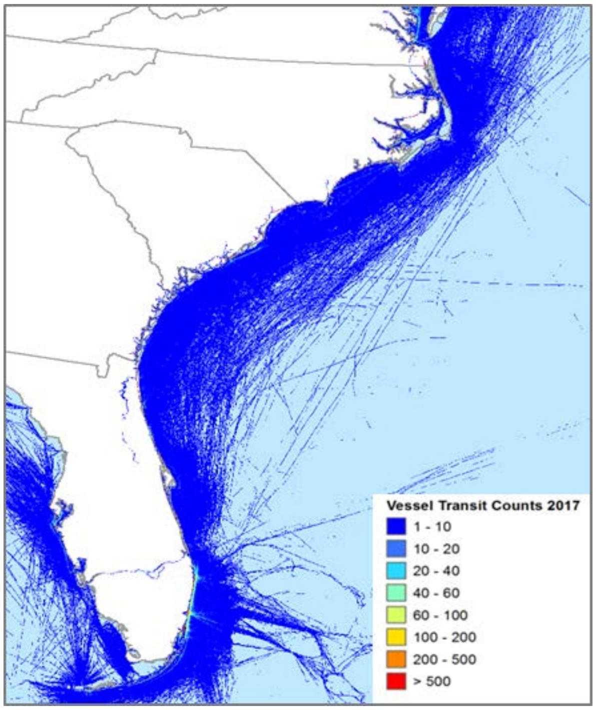

Source: MARAD 2018

Recreational vessels frequently use South Atlantic waters for activities such as fishing, viewing (e.g., whale watching), scuba diving, and swimming. Figure 3-10 illustrates the density of recreational boats on the South Atlantic coast based on AIS data. This includes pleasure crafts and sailing vessels. However, it may underestimate traffic since unlike commercial vessels, the locations of recreational vessels are not regularly tracked and AIS is optional for many recreational vessels; therefore, there is less locational information on recreational vessel trips compared to commercial trips. However, National Marine Fisheries Service (NMFS) conducts surveys of recreational fishermen that include relevant data on the numbers and types of fishing trips (e.g., party, charter, rental, and private boat trips) to inland waters, territorial seas, and federal OCS waters (see Section 3.7.2 for discussion of recreational fishing).

Exhaust emissions from vessels travelling off the South Atlantic coast are governed by the International Maritime Organization (IMO) air pollution rules, which created an Emission Control Area (ECA). The current North American ECA extends 200 nautical miles off the coast of the U.S. and Canada, however in the South Atlantic this boundary comes closer to the coast due to other national waters (e.g., the Bahamas) which are not a part of the ECA (EPA 2010). The EPA and USCG jointly and cooperatively enforce the limits. Within the North American ECA, vessels have limits on sulfur oxide and nitrous oxide emissions as well as being prohibited from emitting ozone depleting substances (EPA 2010). The North American ECA became enforceable in August 2012 with fuel sulfur standards of 0.1% (mass-on-mass) as of 2015 (Congressional Research Service 2018). Nitrous oxide limits are determined by vessel speed (EPA 2010).

Vessels are able to store multiple types of fuel onboard so operators may switch from higher emitting fuels to lower emitting fuels when entering the ECA (EPA 2010). Operators also may opt to install “scrubbing” technology instead of changing fuels (EPA 2010).

**Figure 3-10. 2012 Recreational Boating (Pleasure Craft and Sailing) Activity in the South Atlantic**




### *3.6.3 Reasonably Foreseeable Future Activities*

Multiple trends affect the level of vessel traffic in the South Atlantic. The cruise industry has recently expanded, with a 21% increase in cruise passengers from 2011 to 2016 (CLIA 2017). Global vessel fuel standards determined by the IMO are scheduled to become more stringent in 2020 falling to 0.5%. These fuel standards are still less stringent than the requirement for the North American ECA (Congressional Research Service 2018). Certain vessels also were exempt from nitrous oxide requirements until 2025 (USCG 2014).

Ports such as the Charleston Harbor, the Port of Jacksonville, and the Port of Savannah have recently or will soon undertake deepening efforts in coordination with USACE to accommodate the deeper-draft vessels now transiting the recently expanded Panama Canal locks. It is expected that these deepening efforts will bring larger vessels to these deepened ports (South Carolina Ports Authority 2019, Jaxport 2019a, USACE 2017a). (Additional information on ports is provided in Section 3.11, Land Use and Coastal Infrastructure.)

Since the canal opened in 1914, the size of ships that could transit the canal was determined by the canal lock chambers (length of 965 feet and width of 106 feet), "Panamax" vessels, which has a ship capacity of about 4,500 TEUs (cargo containers, twenty-foot equivalent units). The Panama Canal Authority built a larger set of chambers (length of 1,401 feet and width of 180 feet), completed in 2016, to accommodate larger "New-" or "Neo-Panamax" vessels that have a capacity of 12,000 TEU. The cargo shipping industry is trending towards these bigger ships because of economies of scale for vessel construction and operations (Le 2013).

Port facilities are not the only maritime operations that are adapting to larger ships. As ships get bigger, tugs and their gear, e.g., winches and braking capacity, have to increase as well (Workboat 2016). Also, as the large container ships transiting world trade routes grow even larger, they hold down the cost of ocean shipping, but also raise concerns among vessel operators, insurers, and regulators about the potential for catastrophic accidents (WSJ 2015).

The data show steady trends in the number of vessel calls at ports and terminals in the South -Atlantic from 2006 to 2015 (Table 3-18 and Figure 3-9), and the data suggest that, vessel traffic is expected to remain relatively steady into the reasonably foreseeable future. Major vessel traffic routes are also expected to be relatively stable (MARAD 2019).

### *3.6.4 Impact-Producing Factors Associated with Marine Transportation, Navigation, and Traffic*

Marine transportation, navigation, and traffic may result in the following impacts, which are also potential IPFs for wind energy:

- Accidental releases, fuel/fluids/hazmat
- Accidental releases, trash and debris
- Air emissions, vessels
- Discharges, vessels
- Light, vessels, above water
- Light, vessels, underwater
- Noise, vessels
- Port utilization, expansion
- Traffic, vessel strikes, sea turtles and marine mammals
- Traffic, vessels.

Marine transportation, navigation, and traffic IPFs that do not materially overlap with offshore wind energy include:

- Accidental releases, invasive species and
- Port utilization, maintenance, dredging.

## 3.7 COMMERCIAL AND RECREATIONAL FISHING

### *3.7.1 Description of Action and Activities*

In order to provide context for a cumulative impacts scenario, this section provides information on the past, present and reasonably foreseeable future activities related to commercial and recreational fishing activities. These activities can contribute to cumulative impacts on resources affected by a proposed offshore wind energy project. This section summarizes and briefly highlights what, where, and how much activity related to commercial and recreational fishing is occurring in the area offshore of the Atlantic coast from North Carolina to Florida.

The South Atlantic supports regionally and nationally important commercial and recreational fisheries. Commercial fishing refers to fishing in which the fish that are caught, either in whole or in part, are intended to enter commerce through sale, barter or trade. Recreational fishing includes sport or pleasure fishing either on private or for-hire vessels. Recreational fishing catch may be released or retained for personal consumption but cannot be sold for profit. Impacts from commercial and recreational fishing depend on the status of the species fished, fishing methods, and the magnitude of takings.

**Commercial Fishing**

Guided by the Magnuson-Stevens Fishery Conservation and Management Act (MSA) of 1976, NOAA Fisheries works to ensure sustainable practices for fisheries around the country. NOAA Fisheries partners with regional fishery management councils to predict the abundance of fish stocks, set catch limits, and promulgate and ensure adherence to regulations. For fisheries occurring off the Atlantic coast offshore of

North Carolina to Florida, these councils include the Mid-Atlantic Fishery Management Council (MAFMC), the South Atlantic Fishery Management Council (SAFMC), and the Atlantic States Marine Fisheries Commission (ASMFC).

In addition to regulations stemming from the MSA, many fisheries are subject to additional regulations resulting from the protection of species under the Endangered Species Act (ESA) of 1973 or the Marine Mammal Protection Act (MMPA) of 1972. NOAA Fisheries is responsible for recovering protected marine species such as sea turtles and Atlantic salmon among others, including minimizing the extent to which they are incidentally caught as bycatch in other fisheries. Within state waters, various departments have authority to regulate fisheries; some towns and cities manage nearshore shellfisheries activity within their boundaries.

The main commercial fishing gear used in commercial fishing off the Atlantic coast offshore of North Carolina to Florida are pots/traps, dredges, trawls, longlines (bottom and pelagic), gillnets, purse seines, and pound nets. Table 3-18 lists the types of gear utilized in the various fisheries occurring in the Atlantic. Utilization of mobile bottom tending gears such as bottom trawls and dredges are most likely to contribute to cumulative impacts on sediments and benthic habitats (BOEM 2018a). Impacts resulting from gear utilization depend on factors such as gear type and habitat vulnerability (ICES 2000; NRC 2002).

Table 3-19 provides information on the peak harvest seasons and general area fished by species, for managed fisheries in the Greater Atlantic and Southeast managed fisheries regions.

**Table 3-18. Gear Utilization by Target Species**

| Relevant Target Species | Longlines (Pelagic) | Longlines (Bottom) | Trawls | Dredges | Gillnets | Pound Nets | Purse Seines | Traps/ Pots | Fish Aggregating Devices |
|---|---|---|---|---|---|---|---|---|---|
| Barracuda | | | | | ✓ | | | | |
| Black sea bass | | | | | | | | ✓ | |
| Bluefish | | | | | | ✓ | | | |
| Catfish | | | | | | ✓ | | | |
| Clams | | | | ✓ | | | | | |
| Conch | | | | ✓ | | | | | |
| Crabs | | | ✓ | ✓ | | | | ✓ | |
| Dogfish | | | ✓ | | | | | | |
| Dolphin fish (Atlantic Mahi mahi) | | | | | | | | | ✓ |
| Eels | | | | | | | | ✓ | |
| Flounder | | ✓ | ✓ | | | ✓ | | | |
| Halibut | | ✓ | | | | | | | |
| Herring | | | | | ✓ | | | | |
| Lobster | | | | | | | | ✓ | |
| Menhaden | | | | | | ✓ | | | |
| Mullet | | | | | ✓ | | | | |
| Mussels | | | | ✓ | | | | | |
| Other billfish | ✓ | | | | | | | | ✓ |
| Other Groundfish (cod, haddock, pollock, hake) | | ✓ | | | ✓ | | | | |
| Oysters | | | | ✓ | | | | | |

**Table 3-18. Gear Utilization by Target Species**

| Relevant Target Species | Longlines (Pelagic) | Longlines (Bottom) | Trawls | Dredges | Gillnets | Pound Nets | Purse Seines | Traps/ Pots | Fish Aggregating Devices |
|---|---|---|---|---|---|---|---|---|---|
| Pelagic schooling fish | | | | | | | ✓ | | |
| Red hake | | | ✓ | | | | | | |
| Rockfish | | | | | ✓ | | | | |
| Salmon | | | | | ✓ | | | | |
| Scallops | | | | ✓ | | | | | |
| Scup | | | | | | | | ✓ | |
| Sea cucumbers | | | | ✓ | | | | | |
| Sea urchins | | | | ✓ | | | | | |
| Seabass | | | | | ✓ | | | | |
| Shad | | | | | ✓ | | | | |
| Sharks | | ✓ | | | ✓ | | | | |
| Shrimp | | | ✓ | | | | | | |
| Squid | | | ✓ | | | | ✓ | | |
| Sturgeon | | | | | ✓ | | | | |
| Swordfish | ✓ | | | | ✓ | | | | |
| Tuna | ✓ | | | | ✓ | | ✓ | | ✓ |
| Whelk | | | | | | | | ✓ | |
| Whiting | | | ✓ | | | | | | |

Source: NOAA 2019a

**Table 3-19. Peak Harvest Season of the Top 25 Commercially Fished Species in the South Atlantic (by Landings Value in 2017)**

| Species [1] | Peak Harvest Season [2] | Area Fished [3] | Management Authority [4] |
|---|---|---|---|
| Blue Crab | Varies by state, trap harvest state and regional closures | NY to AL | State managed |
| Caribbean Spiny Lobster | FL Atlantic Coast: Late August through March, year-round above FL | NC to TX | SAFMC, GMFMC |
| White Shrimp [5] | Year-round, closures may be implemented periodically | NC to TX | SAFMC |
| Stone Crab | Mid October- Mid May | FL to TX | State managed |
| Pink Shrimp [5] | Year-round, closures may be implemented periodically | NC to TX | SAFMC |
| Red Grouper | May-December, ACL | MA to TX | SAFMC |
| Brown Shrimp [5] | Year-round with peaks in summer, closures may be implemented periodically | NC to TX | SAFMC |
| Eastern Oyster | Year-round, closures vary by region | NY to TX | State managed |
| Flounders (various) | Year-round, no annual South Atlantic closures | NC to TX | NEFMC, ASMFC, MFMC, may be state managed depending on species |
| Swordfish | June-October | NY to TX | Atlantic HMS Management Division |
| King Mackerel | March-February or when quota is filled | NY to TX | SAFMC, GMFMC |

**Table 3-19. Peak Harvest Season of the Top 25 Commercially Fished Species in the South Atlantic (by Landings Value in 2017)**

| Species [1] | Peak Harvest Season [2] | Area Fished [3] | Management Authority [4] |
|---|---|---|---|
| Penaeid Shrimp (various)[5] | Year-round, closures may be implemented periodically | GA to FL | SAFMC, GMFMC and may be state managed depending on species |
| Striped (Liza) Mullet | Year-round, regional closures | NC to TX | State managed |
| Red Snapper | Year-round, ACL | NC to TX | SAFMC |
| Vermilion Snapper | August-November, ACL | NC to TX | SAFMC |
| Yellowtail Snapper | August-July, ACL | NC to TX | SAFMC |
| Yellowfin Tuna | Year-round, ACL | MA to TX | Atlantic HMS Management Division |
| Gag Grouper | May-December, ACL | NC to TX | SAFMC |
| Quahog Clam | Year-round | CT, NJ, VA, FL | MFMC and state managed |
| Spanish Mackerel | March-February or when quota is filled | RI to AL | SAFMC |
| Rock Shrimp [5] | July-October, closures may be implemented periodically | NC to TX | SAFMC |
| Atlantic Croaker | Year-round | NY to TX | State managed |
| Dolphinfish | Year-round, ACL | NY to TX | SAFMC, GMFMC |
| Bigeye Tuna | Year-round | MA to FL | Atlantic HMS Management Division |
| Golden Tilefish | Year-round, ACL | MA to TX | SAFMC |

Sources: FL FWCC 2019; NOAA 2019d; NOAA 2019k; NOAA 2019l; NOAA 2019m; SAFMC 2019b.

Notes:
[1] This column lists the top 25 species landed in 2017 by value based on landings reported by NOAA Fisheries (NOAA 2019d). Commercially landed fish are not always identified by individual species. In some cases, multiple species are grouped together within the NOAA landings data (i.e., Penaeid shrimp, flounders). These groupings may include species that are also reported separately in other instances. In particular, the Penaeid shrimp group includes pink, white, and brown shrimp and various additional species. Flounders includes approximately 30 species.
[2] Season is based on information from fishery management council (FMC) where available (SAFMC 2019b) or else based on availability as specified on NOAA's fishwatch website (NOAA 2019l). ACL (Annual Catch Limit) indicates that a season will be closed when the annual catch limit is met.
[3] Area fished is based on 'Source' information from NOAA's fishwatch website (NOAA 2019l), or if not available there based on the states where landings were reported from 2008 to 2017 in the NOAA Fisheries data (NOAA 2019d).
[4] For federally managed species, management authority indicates the FMC under which the Fishery Management Plan has been implemented, where applicable. These include the South Atlantic Fishery Management Council (SAFMC), the Gulf of Mexico Fishery Management Council (GMFMC), the Atlantic States Marine Fisheries Commission (ASMFC), the Mid-Atlantic Fishery Management Council (MFMC), and the New England Fishery Management Council.
[5] White, pink, brown, and rock shrimp are managed under the Shrimp Fishery Management Plan which allows for NC, SC, GA, and east FL to request a closure in federal waters adjacent to closed state waters following severe cold weather resulting in 80% or greater reduction in the population of white shrimp.

## Recreational Fishing

Recreational fishing is a major public use of coastal natural resources along the Atlantic coast from North Carolina to Florida. Marine recreational fishing may take place from shore, aboard private or rented boats, and on boats that take passengers for hire. Recreational fishing is a year-round activity, but anglers may target specific species at certain times, and recreational fishing effort is often weather-dependent. Thus, more recreational fishing effort occurs during spring through summer. The types and numbers of fish caught by recreational anglers vary by state. The top species groups harvested by number of fish caught by recreational anglers in the North Carolina to Florida area in 2018 include drums, mullets, porgies, snappers, and jacks (NOAA 2019c).

### 3.7.2 Past and Present Activity

**Commercial Fishing**

In 2017, commercial fisheries harvested approximately 194 million pounds of fish and shellfish in the four-state region (including North Carolina, South Carolina, Georgia and Florida), with a total landed value of over $397 million (2018 dollars); over the period from 2008 to 2017, average annual landings were 190 million pounds with a value of $376 million (NOAA 2019d).[7] The top five species by landing value in 2017 for the four-state region included for the four-state region included white shrimp, blue crab, Caribbean spiny lobster, pink shrimp, and stone crab (NOAA 2019d). Total values and pounds landed over the past ten years are shown in Figure 3-11, based on data from NOAA Fisheries. Between 2008 and 2017, the value of landings ranged from $305 million to $431 million, while landings weight ranged from 179 million pounds to 210 million pounds.

**Figure 3-11. Commercial Landings, Four States Combined**


Source: NOAA 2019d. Note: data presented in this figure include landings from both coasts of Florida.

[7] Note, these data include landings from both coasts of Florida.

The top commercial fishing ports along the Atlantic coast from North Carolina to Florida, ranked by value of landings and pounds of landings are summarized in Tables 3-20 and 3-21 below. Figure 3-12 illustrates the location of the commercial fishing ports that fall within the top U.S. ports ranked by NOAA Fisheries in terms of dollar value and/or pounds landed.

Figure 3-13 illustrates the relative amount of commercial fishing vessel activity along the Atlantic coast from North Carolina to Florida. These data are available from NOAA's Office for Coastal Management based on Automatic Identification System (AIS) data.[8] As Figure 3-13 shows, the highest density of commercial fishing vessel traffic in this region occurs in Pamlico Sound and offshore North Carolina.

**Table 3-20. Commercial Landings at Major South Atlantic Ports, by Value (Millions of Nominal Dollars)**

| State/Port | 2013 | | 2014 | | 2015 | | 2016 | | 2017 | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Rank | Value | Rank | Value | Rank | Value | Rank | Value | Rank | Value |
| **North Carolina** | | | | | | | | | | |
| Wanchese-Stumpy Point | 54 | 21.3 | 46 | 26.6 | 40 | 26.6 | 53 | 21.3 | 48 | 24.0 |
| Beaufort-Morehead City | 76 | 11.7 | 70 | 14.6 | 53 | 20.3 | 63 | 18.2 | 54 | 20.6 |
| Engelhard-Swanquarter | 94 | 7.4 | 84 | 10.4 | 68 | 13.6 | 77 | 12.9 | 71 | 12.8 |
| Oriental-Vandemere | 110 | 4.5 | 102 | 6.4 | 84 | 9.7 | 87 | 10.5 | 85 | 9.8 |
| Sneads Ferry-Swansboro | 108 | 4.6 | 110 | 4.7 | 112 | 5.6 | 106 | 6.6 | 111 | 5.8 |
| Belhaven-Washington | 118 | 3.2 | 113 | 4.4 | 95 | 8.3 | 124 | 3.2 | 124 | 2.6 |
| Elizabeth City | 121 | 2.6 | 124 | 2.7 | 122 | 2.6 | 129 | 1.6 | 128 | 1.2 |
| Columbia | N/A | N/A | N/A | N/A | 72 | 11.4 | 127 | 2.9 | 126 | 2.4 |
| **Georgia** | | | | | | | | | | |
| Darien-Bellville | 105 | 5.4 | 96 | 7.2 | 91 | 8.7 | 111 | 5.9 | 95 | 8.5 |
| Savannah | 119 | 2.7 | 117 | 3.6 | 121 | 3.3 | 125 | 3.1 | 119 | 3.9 |
| Brunswick | 122 | 2.3 | 119 | 3.5 | 120 | 3.7 | 130 | 1.5 | 127 | 2.4 |
| **Florida** | | | | | | | | | | |
| St. Augustine | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | 41 | 27.6 |
| Cape Canaveral | 98 | 6.9 | 71 | 14.1 | 71 | 12.1 | 82 | 12.0 | 63 | 15.2 |
| Mayport | N/A | N/A | 101 | 6.5 | 114 | 5.2 | 120 | 5.0 | 114 | 5.5 |
| Fernandina Beach | N/A | N/A | N/A | N/A | N/A | N/A | 121 | 5.0 | 112 | 5.7 |

Note: None of the ports in South Carolina are included NOAA's list of the top fishing ports in the United States.
Source: NOAA 2019d.

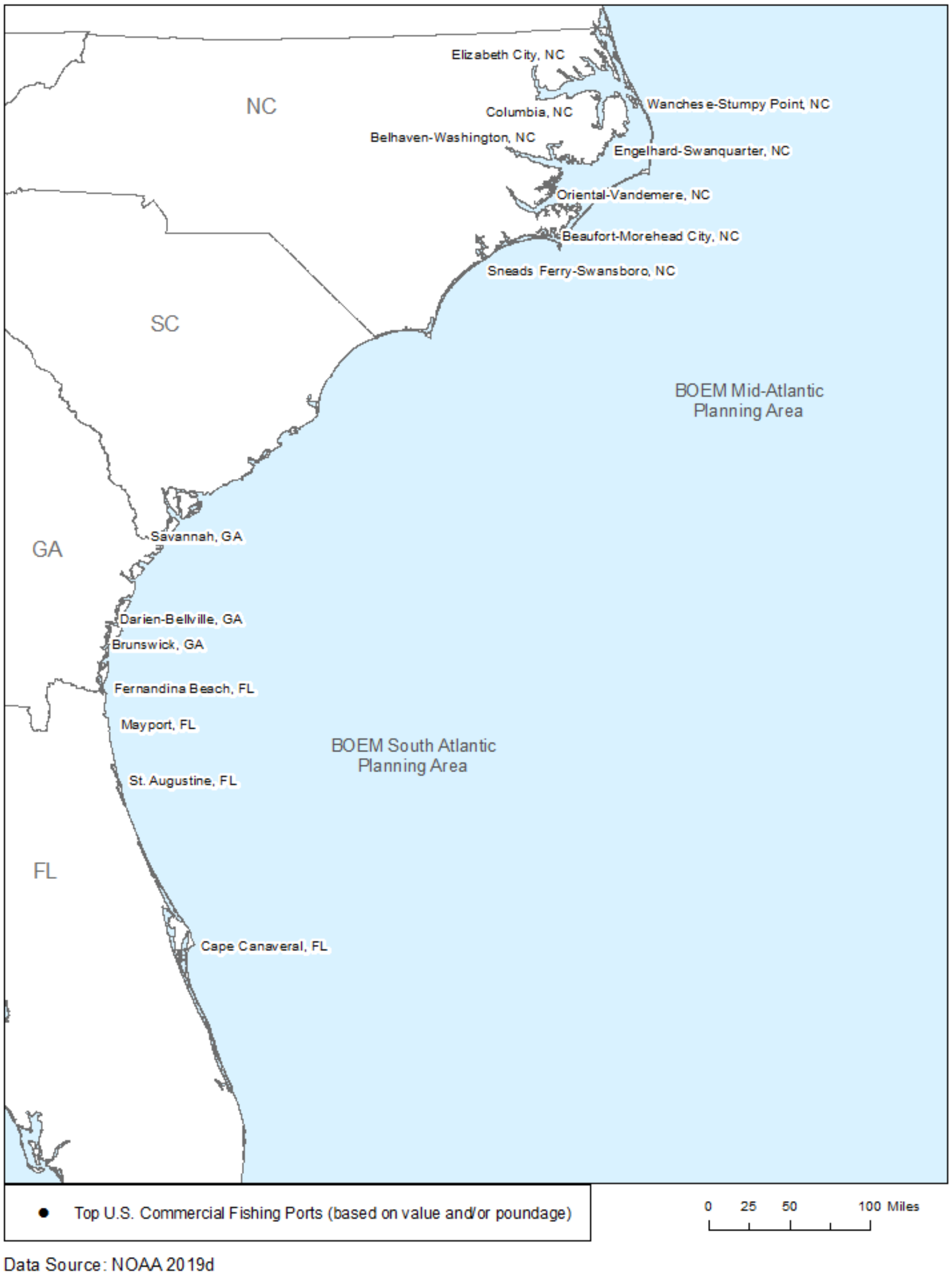
[8] NOAA OCM 2019. This dataset represents annual vessel transit counts summarized at a 100 m by 100 m geographic area. A single transit is counted each time a vessel track passes through, starts, or stops within a 100 m grid cell.

**Table 3-21. Commercial Landings at Top Major South Atlantic Ports, by Poundage (Millions of Pounds)**

| State/Port | 2013 | | 2014 | | 2015 | | 2016 | | 2017 | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Rank | Value | Rank | Value | Rank | Value | Rank | Value | Rank | Value |
| **North Carolina** | | | | | | | | | | |
| Wanchese-Stumpy Point | 48 | 16.1 | 38 | 22.3 | 39 | 18.2 | 40 | 16.1 | 45 | 15.7 |
| Beaufort-Morehead City | 80 | 6.4 | 70 | 7.3 | 61 | 8.6 | 66 | 8.0 | 50 | 14.2 |
| Engelhard-Swanquarter | 95 | 4.1 | 89 | 5.2 | 68 | 6.6 | 67 | 7.9 | 61 | 8.9 |
| Oriental-Vandemere | 114 | 1.9 | 107 | 2.5 | 96 | 4.0 | 92 | 4.4 | 91 | 4.1 |
| Sneads Ferry-Swansboro | 116 | 1.8 | 114 | 1.7 | 118 | 1.9 | 113 | 2.6 | 110 | 2.6 |
| Belhaven-Washington | 111 | 2.2 | 102 | 3.3 | 90 | 4.7 | 103 | 3.4 | 114 | 2.5 |
| Elizabeth City | 117 | 1.7 | 109 | 2.0 | 119 | 1.9 | 128 | 1.6 | 130 | 0.9 |
| Columbia | N/A | N/A | N/A | N/A | 70 | 6.5 | 87 | 4.7 | 104 | 3.4 |
| **Georgia** | | | | | | | | | | |
| Darien-Bellville | 82 | 6.2 | 69 | 7.3 | 102 | 3.1 | 111 | 2.9 | 81 | 5.1 |
| Savannah | 118 | 1.6 | 115 | 1.7 | 122 | 1.6 | 124 | 1.8 | 118 | 2.1 |
| Brunswick | 122 | 1.0 | 124 | 1.1 | 124 | 1.5 | 130 | 0.7 | 127 | 1.0 |
| **Florida** | | | | | | | | | | |
| St. Augustine | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | 67 | 7.0 |
| Cape Canaveral | N/A | N/A | 103 | 3.0 | 97 | 4.0 | 108 | 3.0 | 72 | 6.6 |
| Mayport | 106 | 2.6 | 90 | 5.0 | 82 | 5.7 | 84 | 5.0 | 73 | 6.4 |
| Fernandina Beach | N/A | N/A | N/A | N/A | N/A | N/A | 123 | 2.0 | 117 | 2.3 |

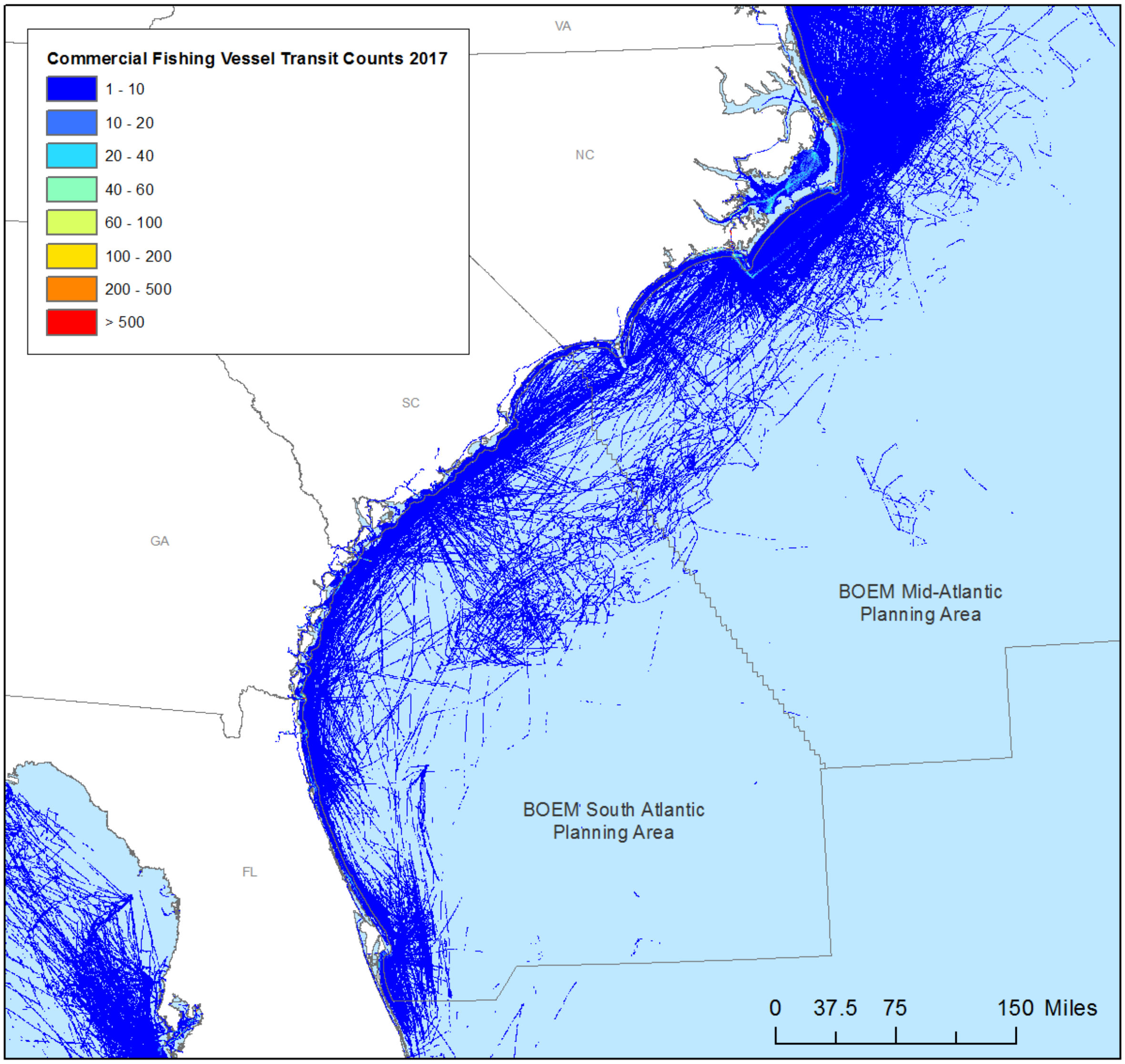
Note: None of the ports in South Carolina are included NOAA’s list of the top fishing ports in the United States.
Source: NOAA 2019d.

**Figure 3-12. Top U.S. Commercial Fishing Ports along the Atlantic Coast from North Carolina to Florida by Value and/or Poundage**




Source: NOAA 2018c.

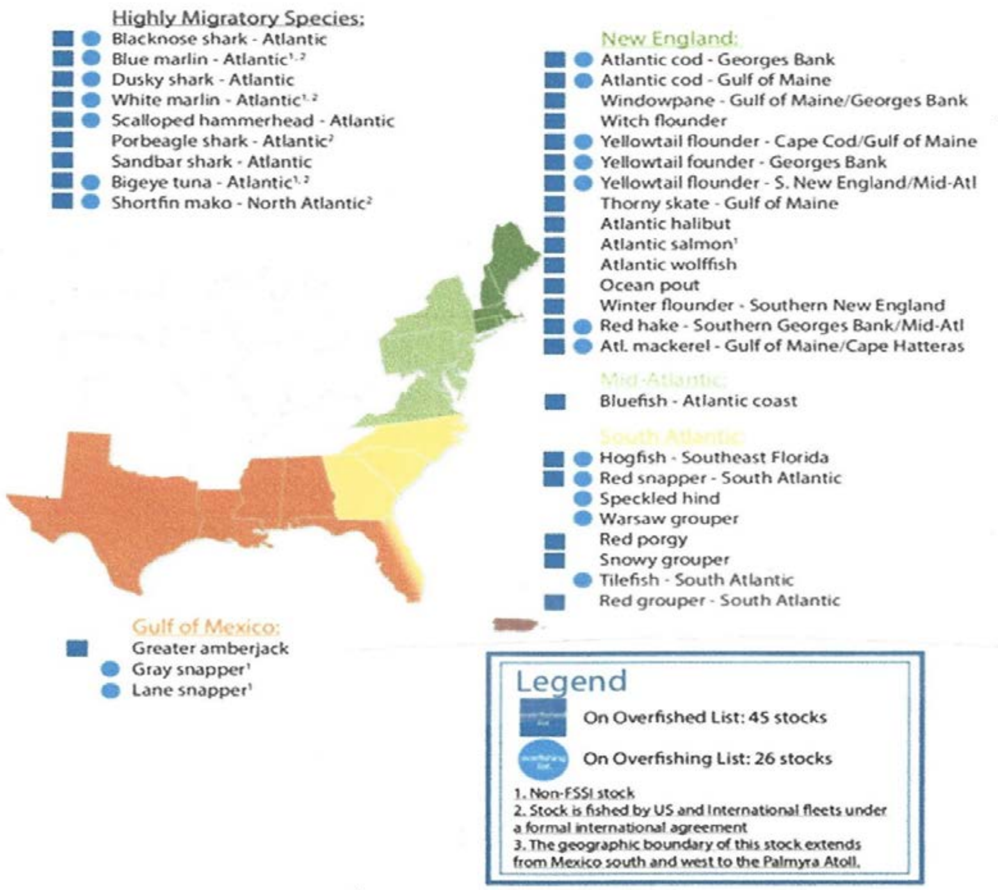
**Figure 3-13. Commercial Fishing Vessel Activity Based on AIS Data**




Data Source: BOEM, NOAA, USCG AIS

As discussed above, fishing activity is managed by NOAA Fisheries with a goal of sustainable fisheries. Fishing activity, along with other factors, can affect the status of a fishery stock. To the extent that overfishing is occurring or a stock is already overfished, fisheries resources may be at risk of cumulative impacts. Figure 3-14 provides information on the stock status for stocks by fisheries region. Of the stocks in the South Atlantic region, based on NOAA Fisheries latest quarterly information, there are eight stocks that are currently on either or both the overfished list (i.e. stock having a population size that is too low and that jeopardizes the stock's ability to produce its maximum sustainable yield) or overfishing list (i.e., a stock having a harvest rate higher than the rate that produces its maximum sustainable yield). In addition, nine stocks of highly migratory Atlantic species were either on the overfished or overfishing lists.

**Figure 3-14. NOAA Fisheries Stock Status September 30, 2019**




Source: NOAA 2019e

## Recreational Fishing

Data on recreational fishing are collected by the NMFS through its Marine Recreation Information Program (MRIP). NMFS estimates that in 2016, 2.3 million resident anglers participated in recreational fishing across the four-state region from North Carolina to Florida in coastal and marine waters; the bulk of this activity was in coastal areas (1.8 million participants), while the remainder (0.5 million participants) were in non-coastal areas (NOAA 2019c). Anglers took 23.4 million trips in 2018, primarily in private boats or from shore. Recreational harvest in 2018 totaled 47.7 million pounds (NOAA 2019c). Recreational fishing trips and total harvest in 2018 are broken down by state in Table 3-22; these include estimates of recreational fishing activity from private boat, and for-hire boats but not inland or from shore.

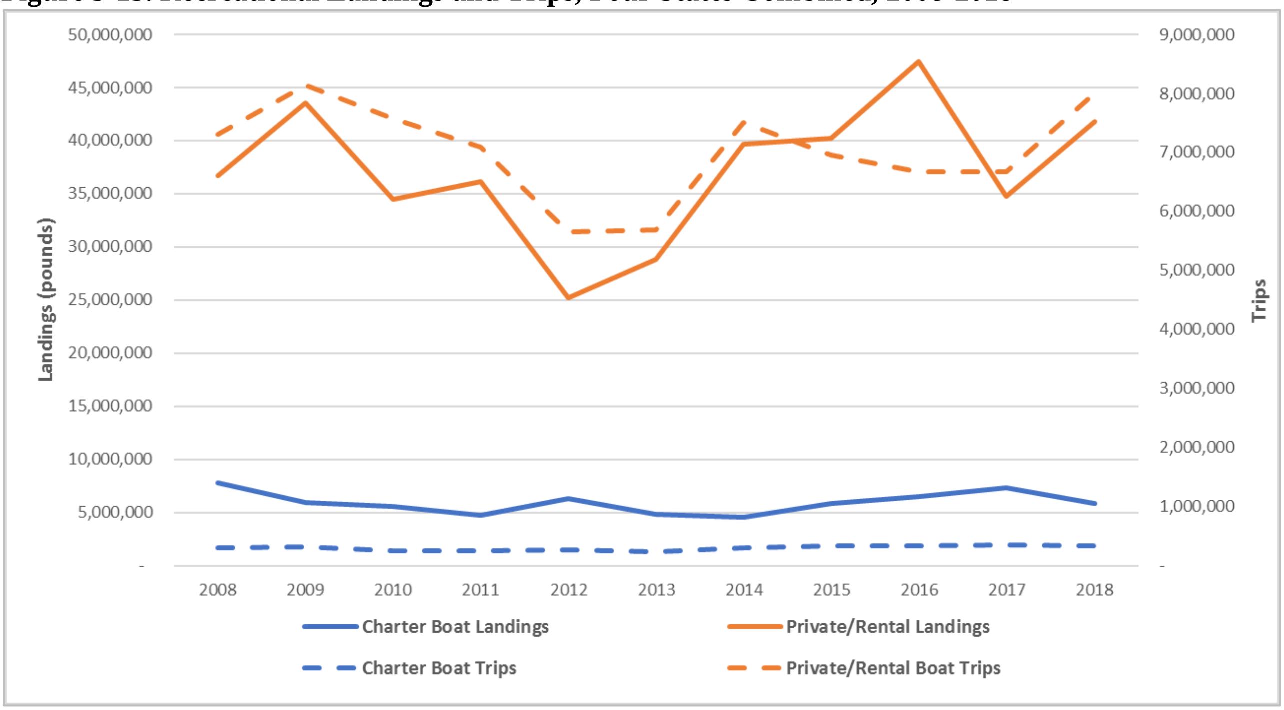
Additional recreational fishing trend data were compiled from NMFS recreational fishing data for offshore waters (territorial seas and federal OCS waters) for the period 2008 to 2018. Data included recreational fishing trips and total landings for the South Atlantic states (North Carolina, South Carolina, Georgia, and the eastern coast of Florida). The results are shown in Figure 3-15, with total trips on the right-hand axis, and total landings in pounds on the left-hand axis. The total landings represent all fish brought ashore, but not necessarily all fish caught.

**Table 3-22. 2018 Recreational Fishing Statistics**

| State | Number of Trips | Percent of Total Trips | Harvest (Total Weight, lbs) | Percent of Total Harvest |
|---|---|---|---|---|
| Florida | 14,943,937 | 64% | 33,288,348 | 70% |
| Georgia | 1,632,333 | 7% | 1,250,053 | 3% |
| North Carolina | 4,427,392 | 19% | 9,998,979 | 21% |
| South Carolina | 2,410,253 | 10% | 3,121,565 | 7% |
| **TOTAL** | 23,413,915 | 100% | 47,658,945 | 100% |

Source: NOAA 2019c. Note, this data includes recreational fishing trips to and harvest from brackish/estuarine waters, territorial seas, and federal OCS waters; it does not include trips to or harvest from inland fresh waters. These data include trips and harvest from both coasts of Florida.

**Figure 3-15. Recreational Landings and Trips, Four States Combined, 2008-2018**




Source: NOAA 2019

These data indicate recreational fishing trips have been relatively steady over the past ten years, with private/rental boat trips comprising the majority of total offshore trips and landings. While private/rental boat trips decreased between 2011 and 2012 this was followed by a recovery in 2014. Some variation is likely a reflection of general economic conditions, e.g., a 30% decline from 8.5 million trips in 2009 to 5.9 million trips in 2012 during the recession in the U.S. Other variations are not as easily explained, e.g., a nearly 20% increase from 7.0 million trips in 2017 to 8.3 million trips in 2018. When examining earlier data from NOAA's MRIP database, apart from the decline from 2009-2012, there has been a gradual increase in recreational fishing effort in the South Atlantic AOI since 2001.

### 3.7.3 Reasonably Foreseeable Future Activities

Fishery management councils develop management plans for marine fisheries in waters seaward of state waters of their individual regions. Plans and specific management measures (such as fishing seasons, quotas, and closed areas) are developed based on scientific advice, and are initiated, evaluated, and adopted through a public process. The decisions made by the councils are not final until they are approved or partially approved by the Secretary of Commerce through NOAA Fisheries. Fisheries management plans are updated periodically, which may result in changes to regulations affecting fishing activity. Review of fishery management plans and related rules and actions under development may provide insight into whether there may be changes in management expected in the foreseeable future.

More information about the regional fishery management plans is available at the fishery council websites at: http://www.mafmc.org/fishery-management-plans and http://www.fisherycouncils.org/south-atlantic. Although there are variations across years and seasons for fishing activities, as well as geographic differences among states, there are no apparent long-term temporal trends in the level of these activities (BOEM 2014a). Trends in recreational fishing effort have been presented and discussed previously in Section 3.6, Marine Transportation, Navigation, and Traffic.

### 3.7.4 Impact-Producing Factors Associated with Commercial and Recreational Fishing

The following reasonably foreseeable impacts of commercial and recreational fishing activity along the Atlantic coast from North Carolina to Florida may interact with IPFs of offshore wind energy development:

- Accidental releases, fuel/fluids/hazmat
- Accidental releases, trash and debris
- Air emissions, vessels
- Discharges, vessels
- Light, vessels, above water
- Light, vessels, underwater
- Noise, O&M
- Noise, vessels
- Traffic, vessel strikes, sea turtles and marine mammals
- Traffic, vessels.

Additional IPFs from commercial and recreational fishing activities that may not overlap with offshore wind energy IPFs include:

- Accidental releases, invasive species
- Bycatch, bird/fish/sea turtle/marine mammals
- Gear utilization, bottom trawls, bycatch/benthic disruption
- Gear utilization, ghost fishing, entanglement
- Gear utilization, midwater trawls, bycatch/overfishing
- Regulated fishing effort
- Resource exploitation, overfishing
- Resource exploitation, prey/predator removal.

## 3.8 Climate Change

### 3.8.1 Description of Activities

Climate change refers to any significant change in the measures of climate lasting for an extended period of time (EPA 2017). In particular, climate change includes major changes in temperature, precipitation, or wind patterns, among others, that occur over several decades or longer (EPA 2017). Greenhouse gases (GHGs) in the atmosphere (including carbon dioxide ($CO_2$), methane ($CH_4$), nitrous oxide ($N_2O$) and fluorinated gases) persist in the atmosphere for varying periods of time and are emitted naturally as well as through various human activities, such as fossil fuel combustion. GHGs increase atmospheric radiative forcing, trapping radiation inside the planet's atmosphere and increasing temperature. While not a specific action that would be part of a cumulative effects analysis, climate change could directly or indirectly impact all of the resources that are potentially affected by wind energy projects. Climate change should, therefore, be considered in terms of its combined effects with offshore wind energy development.

Warming is caused by the greenhouse effect of these GHGs trapping heat in the Earth's atmosphere (IPCC 2015). The greenhouse effect occurs naturally but the increase of atmospheric GHGs causes increased warming (IPCC 2015). Warming is the primary cause of sea level rise as glacier melts and the thermal expansion of the ocean as it warms (NOAA 2019g). Warming also results in changes to precipitation and other meteorological patterns (NOAA 2014). Ocean acidification results from the oceans absorbing larger amounts of carbon dioxide as atmospheric levels rise. The ensuing chemical reactions create bicarbonate ions acidifying the ocean (PMEL 2018).

Climate change is a disruption to geophysical and biological resources around the world. Temperature, precipitation patterns, and storm frequency and intensity as well as other natural cycles can be altered globally by climate change (IPCC 2015). The impacts of these changes have wide ranging implications for the natural and human environment.

### *3.8.2 Past and Present Activities*

NOAA (2019h) data identifies 2018 as the fourth warmest year on record globally following 2017, 2016, and 2015. The average temperature in 2018 was 1.42 degrees Fahrenheit above the average for the twentieth century (NOAA 2019c). The ten warmest years on the record have occurred since 1998, and 9 of the 10 have occurred since 2005. This warming occurs globally but non-uniformly (NOAA 2019c).

Oceans absorb the majority of temperature increases from climate change. Over the last 50 years, 90% of the warming on Earth has occurred in the oceans, with upper oceans experiencing the majority (60%) of this warming (NOAA 2018). Heat-gain rates in the upper ocean depths of 0 to 700 m were 0.36 to 0.4 watts/$m^2$ between 1993 and 2017, averaged globally (NOAA 2018). Warmer oceans can increase evaporation, altering precipitation patterns leading to more extreme precipitation events.

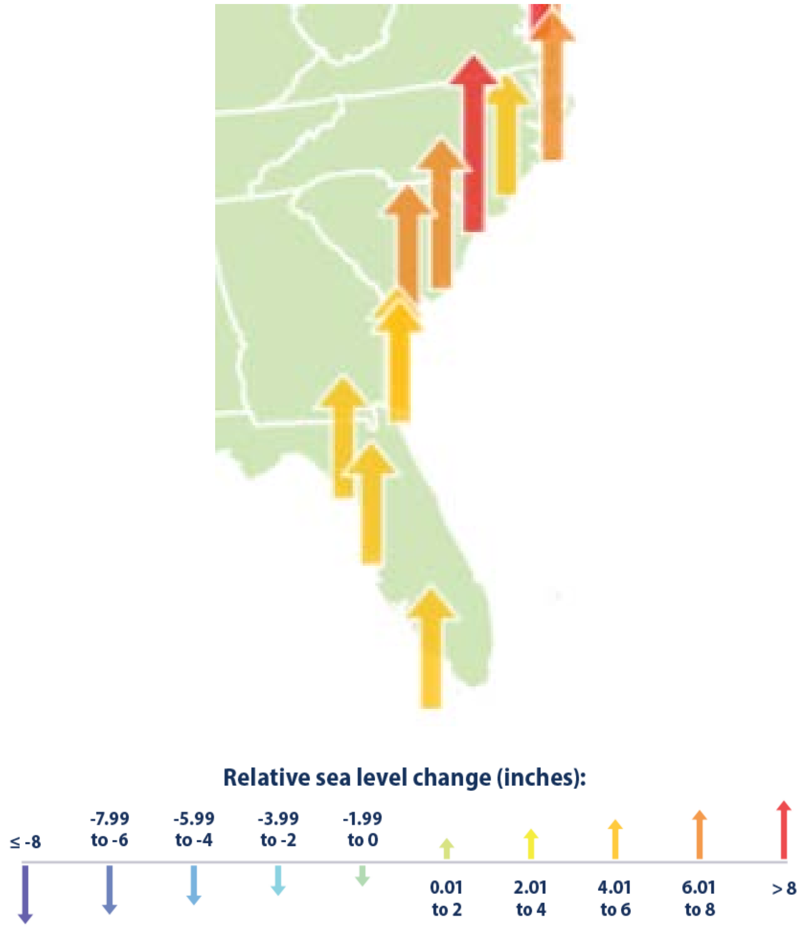
Precipitation patterns also have become more extreme over land; nine of the top ten years for extreme precipitation events have occurred since 1990 (Global Change 2014). The amount of precipitation falling in very heavy events (the heaviest 1% of precipitation events) rose 70% from 1958 to 2010 (Global Change 2014).

This warming causes oceans to expand; raising sea levels consistently over the last century. In 2018, global sea level was 3.2 inches above the 1993 average. This is the highest average since 1993, when satellites began recording sea level rise. NOAA reports that as of 2019, the pace of sea level rise is accelerating (2018a). The average rate of sea level rise since 1993 was one-eighth of an inch per year.

Sea level rise does not occur uniformly. In the Atlantic Ocean, sea level rise along the coast was faster than global averages (Saba et al. 2016). EPA has mapped sea level rise along the Atlantic coast. Sea levels rose from less than 2 inches to greater than 8 inches between northern Florida and Maine; the greatest increases in the Southeast were off the coasts of North and South Carolina (Figure 3-16).The historical mean rate of sea level rise across the Southeast Atlantic is generally consistent with the mean global rate (Ingram et. al. 2013). Global sea level is predicted to rise by 0.7 to 6.6 ft by 2100 (Parris et. al. 2012). Areas that are likely to be impacted can be identified from readily available tools such as Sea Level Rise Viewer. The Park Service also has a viewer that is used to identify areas vulnerable to storm surges.

The global average acidity of the ocean has increased approximately 30% since the Industrial Revolution (PMEL 2018). The pH of ocean waters has decreased from 8.16 to 8.06 as ocean waters have become more acidic (PMEL 2018). (pH is a measure of acidity; the scale is inverse and logarithmic, meaning pH goes down as acidity goes up, and small changes in pH are large changes in acidity.)

**Figure 3-16. Relative Sea Level Rise on the Southeast Atlantic Coast from North Carolina to Florida, 1960-2015**




Source: EPA 2016

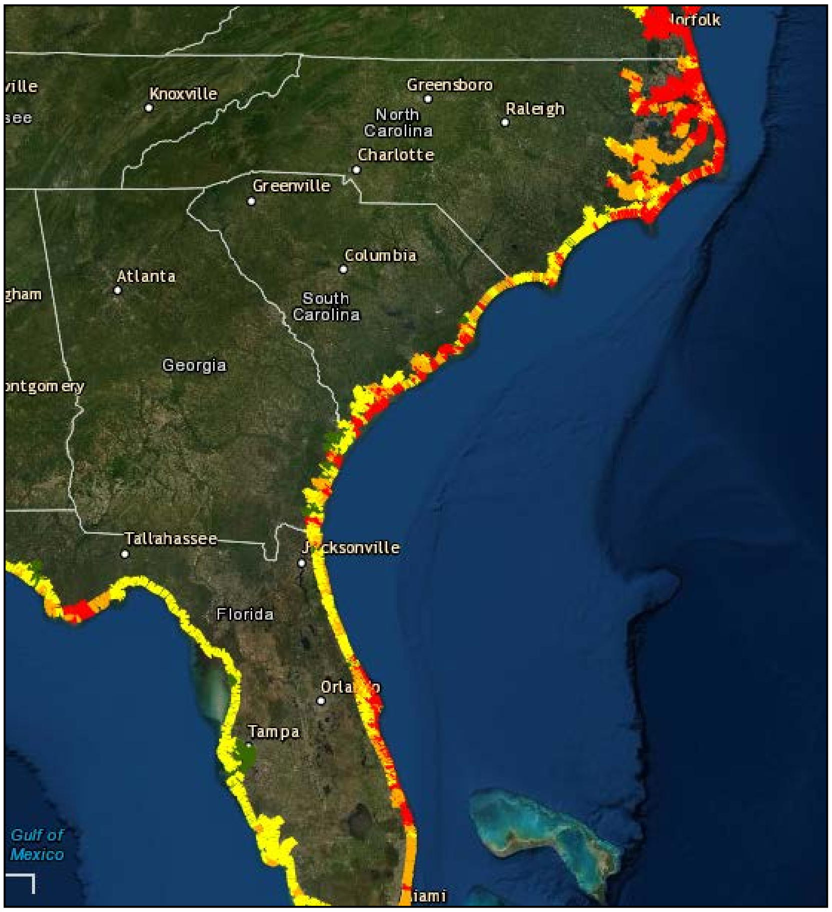
### 3.8.3 Reasonably Foreseeable Future Activities

Global temperature is expected to continue to increase in the next century. Since the future activities of climate change will greatly vary around the world as well as along the Atlantic coast, local vulnerability plans and vulnerability assessments can be used to identify vulnerable resources and localized projections.

By 2020, IPCC models forecast that global warming will be 0.9 degrees Fahrenheit above the 1986 to 2005 average (IPCC 2015). Three scenarios from the Intergovernmental Panel on Climate Change (IPCC) 2015 report forecast global warming between 2 and 9.7 degrees Fahrenheit by 2100. This warming is likely to result in additional extreme events such as heavy precipitation events and extreme temperatures, both cold and warm (IPCC 2015). It will also cause the ocean to continue warming and acidifying (IPCC 2015).

Over time, global mean sea level is projected to rise as more glacier ice melts and the oceans absorb more heat and expand. Extreme precipitation and weather events are also forecast to increase in the next century as climatic systems change. The highest forecast for 2100 projects mean sea level rise of 2 meters above 1992 levels; the lowest forecast projects 0.2 meters above 1992 levels (NOAA 2018a). USGS reports that many regions of the Atlantic coast, from North Carolina to Florida, have "high" or "very high" coastal vulnerability to projected climate change and sea level rise (Figure 3-17; USGS 2018).

**Figure 3-17. USGS Coastal Vulnerability Index for the Atlantic Coast**

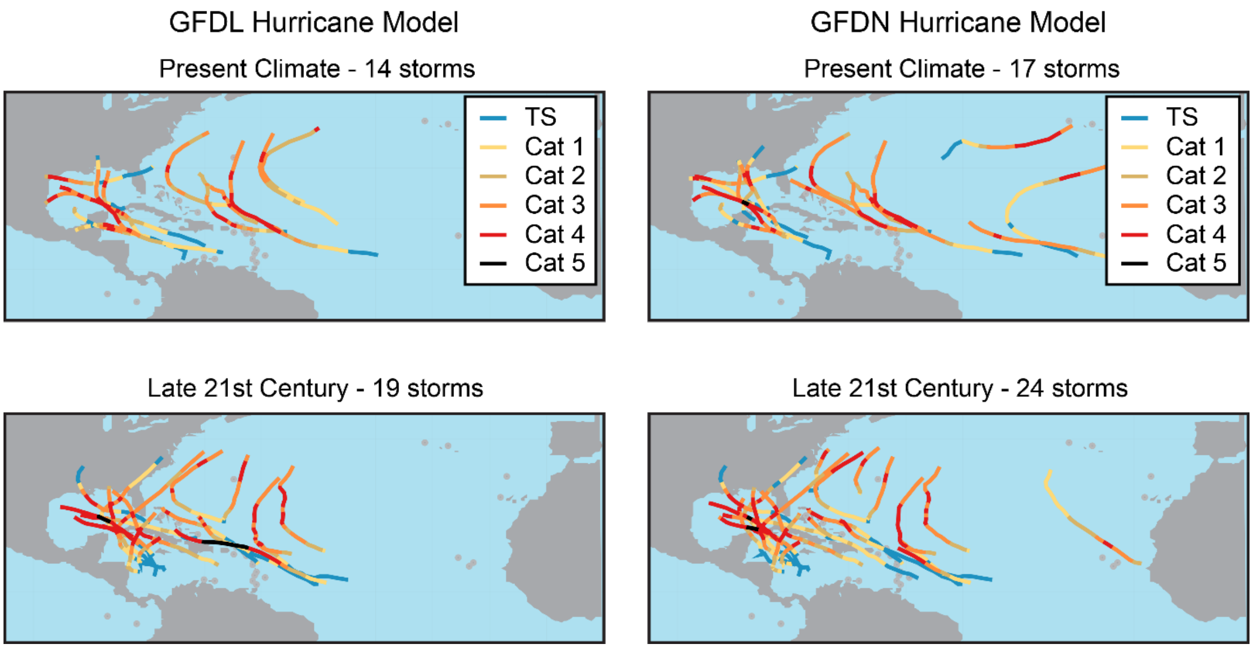



Source: USGS 2018

This vulnerability is due to warming as well as local land subsidence (sinking). In North and South Carolina, localized subsidence may be caused by groundwater extraction and sediment compaction (Parris et. al 2012). In these areas, sea level rise of just inches poses an imminent threat of increased inland flooding during heavy rain events in low-lying coastal areas. In Southeast Florida, sea level rise has the potential to impair the capacity of stormwater drainage systems to empty into the ocean (Global Change 2014). Sea level rise has both static and dynamic impacts. Static sea level rise impacts include permanent inundation of areas. These areas may require efforts to avoid, mitigate, or forestall the long-term rise in sea level, e.g., physical barriers; relocation of structures and activities; and revised zoning, code, and construction requirements. Dynamic sea level rise impacts (episodic effects of sea level rise coupled with increased storm intensity), will include increased occurrences of flooding and damages over larger areas.

There is also evidence that hurricanes and storms will increase in intensity and rainfall in the future due to increasing sea surface temperatures (NOAA 2019f). Projections for the late 20th century also show that future storms may be more likely to veer towards the Caribbean and U.S. South Atlantic coasts than occurred historically (NOAA 2019f). These changes, in combination with rising sea levels will increase the risk and threat to coastal populations, habitats and infrastructure due to storm surge (NOAA 2019f). In addition, there is recent evidence that decreases in the dispersion of heat on the Atlantic Coast could increase the risk of rapidly intensifying hurricanes (Ting 2019). This change is a result of changes to vertical wind shear, which previously reduced hurricane intensity as a storm moved toward land, acting like a "speed bump" (NOAA 2019i, Ting 2019). Figure 3-18 presents the modelling results for current climate conditions and late 20th century results. As shown, additional storms appear likely to hit the Atlantic coast from North Carolina to Florida in these models.

**Figure 3-18. Current and Future Hurricane Formation**




Source: NOAA 2019f

There is also evidence the Gulf Stream and North Atlantic Current may be weakening as a result of global warming and increased freshwater infusion from the Greenland ice sheet (Rahmstorf et al. 2015). If the Gulf Stream weakens, increased regional sea level rise, specifically along the North and mid-Atlantic coast could be even greater than currently modelled, the magnitude of potential future climate change effects varies across the Atlantic Coast, see Section 3.8 of BOEM (2019a) for further discussion of North and Mid-Atlantic specific effects. Despite uncertainty in projections, there is potential for habitat disturbance in coastal environments as well as disruption to marine life due to foreseeable climate change.

### *3.8.4 Impact-Producing Factors Associate with Climate Change*

The reasonably foreseeable impacts of climate change in the South Atlantic, from North Carolina to Florida, that may not directly overlap with offshore wind energy IPFs, but could alter the baseline against which the impacts of human actions are measured, include the following:

- Warming and sea level rise, property/infrastructure damage
- Warming and sea level rise, protective measures (barriers, seawalls)
- Warming and sea level rise, storm severity/frequency
- Warming and sea level rise, storm severity/frequency, sediment erosion, deposition.

- Ocean acidification
- Warming and sea level rise, altered migration patterns
- Warming and sea level rise, altered habitat/ecology
- Warming and sea level rise, disease frequency.

## 3.9 Oil and Gas Surveys and Extraction

### 3.9.1 Description of Action and Activities

Oil and gas activities involve several phases: G&G surveys; exploration, development, production/extraction, and decommissioning/platform removal. G&G surveys are performed to locate map sea bottom features, e.g., to identify manmade, seafloor, or geological hazards; to locate potential archaeological or benthic resources; and obtain geologic data to assess the location and potential of recoverable hydrocarbons. G&G survey activities include: Deep-Penetration Seismic surveys; HRG seismic surveys; electromagnetic, magnetic, gravity, and remote sensing surveys; and geological testing (sampling and drilling or coring). Oil and gas exploration involves mobile drilling units (e.g., jack-ups, semi-submersibles, drill ships) and drilling a series of individual wells to locate and test the recoverability of petroleum reserves. Oil and gas development occurs when economically viable reserves are targeted for extraction and involves drilling multiple wells in close proximity to each other and the installation of a platform to collect the recovered product and transfer it to a pipeline typically for delivery onshore. Oil and gas production involves the extraction of the oil and gas and its transport for onshore processing.

### 3.9.2 Current Activity

BOEM issues G&G permits for hydrocarbon exploration, development, and production. BOEM is currently reviewing nine G&G permit applications that are listed in Table 3-23. The areas under consideration for G&G surveys are in federal waters on the Atlantic OCS and extends from Delaware to Florida. These surveys overlap with the cumulative impact geographic analysis area for birds, bats, sea turtles, marine mammals, finfish, invertebrates, and essential fish habitat.

**Table 3-23. Geological and Geophysical (G&G) Permits Currently Under Review by BOEM**

| Permit Number | Company | Submittal Date | States Adjacent to AOI |
|---|---|---|---|
| E19-005 | CGG Services (US) Inc. | May 24, 2019 | Maryland to Florida |
| E18-001 | ABI Holdings Limited (Austin Exploration) | February 20, 2018 | Delaware to Florida |
| E18-002 | TDI-Brooks International, Inc. | May 29, 2018 | New Jersey to Florida |
| E14-001 | TGS | March 31, 2014 | Delaware to Florida |
| E14-003 | Ion Geophysical/GX Technology Corporation | April 3, 2014 | Delaware to Florida |
| E14-004 | WesternGeco LLC | April 9, 2014 | Virginia to South Carolina |
| E14-006 | Spectrum Geo Inc. | May 8, 2014 | Delaware to Florida |
| E14-007 | Petroleum Geo Services | May 9, 2014 | Virginia, North Carolina |
| E14-010 | TDI-Brooks International, Inc. | October 16, 2014 | North Carolina to Florida |

### 3.9.3 Reasonably Foreseeable Future Activities

The Atlantic has seen minimal oil and gas development interest and activity from the 1970s through the present. Between 1979–1980, seven exploratory wells were drilled in the current planning area with no commercial discoveries. The area was subject to presidential withdrawal from 1998 to July 2008 and to annual Congressional restrictions from FY 1999 through FY 2008. This planning area was analyzed in the Atlantic G&G Programmatic EIS (BOEM 2014a) and the Draft Programmatic EIS for the 2017–2022

Program (BOEM 2016a). A potential lease sale for a portion of this planning area was included in the 2017–2022 DPP decision, but subsequently removed in the 2017–2022 Proposed Program decision (BOEM 2018e).

In the 2019-2024 National Outer Continental Shelf Oil and Gas Leasing Draft Proposed Program (BOEM 2018e) BOEM published a schedule of proposed lease sales. The five-year plan included three lease sales in the South Atlantic in 2020, 2022, and 2024. However, at present there will be no lease sales in 2020. BOEM will need to develop a new five-year program before 2022. At this time, any projections for oil and gas leasing in the Atlantic would be speculative.

For offshore wind energy development activities in the South Atlantic, potential interactions between the northern portion of the South Atlantic AOI and Mid-Atlantic lease sales and OCS wind development, largely due to port and marine operations in and around Norfolk/Hampton Roads, Virginia.

### 3.9.4 Impact-Producing Factors Associated with Oil and Gas Activities

Potential IPFs from oil and gas-related G&G permit activities that may overlap with IPFs of offshore wind energy development include those associated with G&G surveys that currently are considered a reasonably foreseeable future action (marked with asterisks “ * ”) and those related to exploratory drilling, development, or production, which at present are not considered in the reasonably foreseeably cumulative impact scenario:

- Accidental releases, fuel/fluids/hazmat*
- Accidental releases, fuel/fluids/hazmat, structures
- Accidental releases, trash and debris*
- Air emissions, aircraft*
- Air emissions, onshore
- Air emissions, vessels
- Anchoring*
- Discharges, onshore point source and non-point sources
- Discharges, structures
- Discharges, vessels*
- Light, vessels or offshore structures, above water
- Noise, aircraft*
- Noise, demolition/structure removal
- Noise, G&G*
- Noise, O&M
- Noise, vessels*
- Port utilization, expansion
- Presence of structures, offshore space use conflicts
- Traffic, aircraft*
- Traffic, vessel strikes, sea turtles and marine mammals*
- Traffic, vessels.*

IPFs associated with oil and gas-related survey and extraction activities that will not materially overlap with IPFs of offshore wind energy development include:

- Accidental releases, crude oil
- Air emissions, structures
- Demolition/structure removal
- Demolition/structure removal, explosives
- Demolition/structure removal, shock wave
- Discharges, drilling, sedimentation and burial*
- Discharges, drilling, vessels*

- Discharges, drilling, water column*
- Land disturbance, onshore construction
- Light, structures, onshore
- Light, vessels or offshore structures, underwater
- Noise, drilling*
- Noise, offshore
- Noise, onshore
- Noise, trenching
- Pipeline trenching
- Presence of structures, onshore space use conflicts.

## 3.10 Submarine Transmission Lines, Pipelines, Cables and Infrastructure

### *3.10.1 Description of Activities*

A variety of activities require underwater lines, cables, and infrastructure, including:

- Offshore renewable energy development requires subsea transmission line connections to coastal transmission infrastructure. These cables allow electric power produced offshore to be transported and consumed onshore. Subsea transmission cables also link power grids onshore to island power grids. Transmission cables are often high voltage direct current lines, which is then converted back to alternating current when connecting to onshore transmission infrastructure. Power cables are often smaller than 300 mm (11.8 in).

- Pipelines connect offshore LNG import terminals and oil and gas infrastructure to onshore pipelines and infrastructure that then deliver the product to refineries or storage facilities and then to consumers. Offshore pipelines may be constructed for specific infrastructure, such as an offshore oil rig or an offshore LNG import terminal, or used to carry oil and gas long distances underwater from one coast to another. Submarine pipelines for oil and gas infrastructure are typically the largest seabed cables ranging up to 1500 mm (59.1 in) in diameter.

- Submarine telecommunications cables are communication links that can span an entire ocean. These are vital links for commercial telecommunications companies, modern infrastructure, and national security. These cables are typically the smallest and involve fiber optics. A set of international rules are in place to avoid clustering and conflicts between submarine telecommunications cables that run across oceans.[9] Telecommunications cables are often smaller than 50 mm (1.9 in).

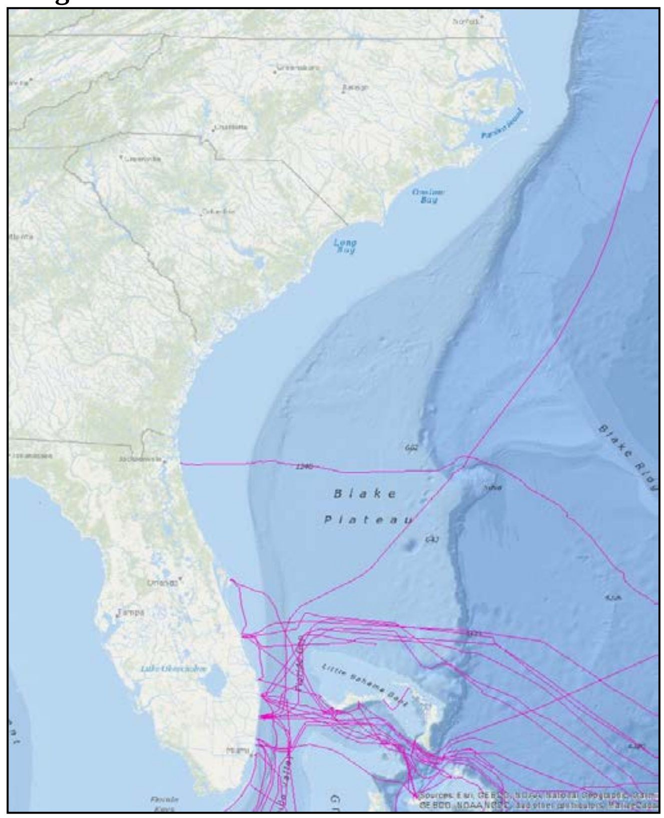
Installing or laying this infrastructure involves coordination of various activities, entities, and permitting, including review by the Federal Communications Commission (FCC), USACE, and NOAA. Depending on the particular project and site characteristics, construction and maintenance of submarine line and cable infrastructure may include the following activities:

- Geologic survey of a proposed cable route
- Use of specialized vessels and submarine equipment, as well as divers, to lay the cable
- Use of a machine or plough to bury the cable in the sea floor
- Surveys following installation
- Construction of (or connection to) a coastal landing station to connect the cable to onshore systems

[9] The primary source of international industry standards is the International Cable Protection Committee (ICPC) and the NASCA, which issues recommendations (intended to be authoritative) for coordinating marine activities and submarine cables. An example recommendation from ICPC is a default separation distance of 500 meters between offshore wind facilities and active cables in shallow water (ICPC 2011a; b).

- Maintenance repairs and/or removal of a cable, potentially including grappling, splicing and replacing cable lines; a submarine cable typically has a 25-year lifespan but can often extend longer.

**Figure 3-19. NOAA Charted Submarine Cables**




Note: This map includes cables that might currently be out of service or inactive. It was last updated in December 2012 and therefore is not comprehensive of all current submarine cables (NOAA 2012).

### *3.10.2 Past and Present Activities*

Current installed underwater lines, cables, and infrastructure are shown in Figure 3-19 and described below.

As of December 2012, NOAA charted three submarine cables in the South Atlantic. All three of these cables are in Florida, two near Titusville and one near Jacksonville (Figure 3-20). These cables are primarily submarine telecommunications cables. Two additional fiberoptic cables were recently installed after approval by the FCC in 2014 and 2015, both making landfall near Jacksonville, Florida. Additional cables traverse the South Atlantic region but do not make landfall. Specifically, two cables begin in Virginia Beach and run along the North Carolina coast as well as through Pamlico Sound though they do not make landfall in North Carolina.

Not all of these cables are currently utilized as certain cables can become obsolete or uneconomical due to technological improvements. The NOAA listing includes active cables as well as those that are currently out of service. The North American Submarine Cable Association (NASCA) also maintains a listing of submarine cables. NASCA, which is focused on telecommunications cables only for their organization members, identifies one cable in the South Atlantic; it is identified as out of service.

Other transmission, telecommunications, and pipeline activity in the AOI include the following:

- BOEM holds the authority over right-of-way grants for the development and installation of transmission lines connecting offshore wind energy projects to onshore electricity grids. BOEM has not issued any right-of-way grants in the South Atlantic.
- No major seabed electricity transmission lines exist in the South Atlantic. The few that exist run short distances to outlying capes or islands such as Cape Hatteras and the Outer Banks of North Carolina.
- Few seabed cables for the telecommunications industry exist in the South Atlantic. The majority of submarine telecommunications cables connect further north in New York, New Jersey, or further south near Miami and the south-east coast of Florida.
- The FCC has six pending submarine cable applications; none of the six would make landfall in the South Atlantic (FCC 2018). Two previously approved cables (operational as of 2018) make landfall

in Virginia Beach, slightly north of the South Atlantic region. Submarine telecommunications cables are consistently being upgraded and enhanced for modern communications.

- There are no submarine pipelines located in the South Atlantic. There are also currently no offshore oil and gas extraction activities in the South Atlantic and hence no pipelines from oil or gas extraction sites. All wells that industry drilled in the South Atlantic were abandoned as non-commercial.

### 3.10.3 Reasonably Foreseeable Future Activities

Submarine telecommunications cables are consistently being upgraded and enhanced for modern communications. As circuit capacity is used, more cables are needed resulting in new cable infrastructure to support telecoms operations. Replacement and repair of existing cables should also be expected in the foreseeable future as current cables reach the end of their effective lifespan or obsolete. However, compared to the North Atlantic (as described in BOEM-2019a) there is limited cable activity overall.

- Additional offshore energy projects would lead to an increase in submarine electricity transmission cables. Kitty Hawk Wind, the ongoing wind energy development project off the Outer Banks in North Carolina, has started high-resolution imaging as of November 2019. The imaging is examining a potential cable line that would make landfall south of Virginia Beach. The cable route would run from the north-east end of the WEA northwest to shore.
- Additional oil and gas development as well new LNG terminals along the Atlantic coastline would require pipelines to connect to consumers and onshore infrastructure. At this time, no LNG terminals have been approved for production and no oil development leases under the current leasing program. No lease sales are scheduled for the lease sale period of 2017 to 2022 in the Atlantic.
- As of April 2018, the FCC has 6 pending applications for submarine cable operations and landings in the U.S.; from 2016 through April 2018 the FCC has granted ten licenses for submarine cable operations and landings in the U.S. Of the six pending applications, none are within the AOI. In addition, the FCC has not granted any licenses for landings within the AOI since 2016 (FCC 2018), though some landings are pending and approved in Boca Raton, Florida, just south of the South Atlantic region and others could potentially run through the AOI depending on the cable route.

### 3.10.4 Impact-Producing Factors Associated with Submarine Transmission Lines, Pipelines, Cables and Infrastructure

The reasonably foreseeable impacts of submarine transmission lines, pipelines, cables and infrastructure that overlap with the IPFs of offshore wind energy development include the following:

- Accidental releases, fuel/fluids/hazmat
- Accidental releases, trash and debris
- Air emissions, vessels
- Discharges, vessels
- Electromagnetic fields
- New cable emplacement/maintenance
- Noise, vessels
- Presence of structures, entanglement, gear loss/damage
- Presence of structures, onshore
- Presence of structures, transmission cable infrastructure
- Traffic, vessel strikes, sea turtles and marine mammals
- Traffic, vessels

There are no IPFs related to submarine lines, cables, and pipelines that do not also overlap with the IPFs of offshore wind energy development.

# 3.11 LAND USE AND COASTAL INFRASTRUCTURE

## *3.11.1 Description of Activities*

Land use on the South Atlantic coast is diverse, encompassing many distinct environments including wetlands, developed areas, forests, and agricultural land. Atlantic coastal environments support a wide range of ecosystems as well as human activities. Developed coastal areas are common on the South Atlantic coast due to the presence of coastal population centers, including recreational, tourism, residential, commercial, and industrial infrastructures (NOAA 2010a; 2010b). Other infrastructure, such as onshore lighthouses and harbors, facilitate marine navigation and offshore activities and development.

American coastal zones are regulated and managed through a cooperative partnership between states and the federal government as part of the Coastal Zone Management Act (CZMA). The program is voluntary and is administered by NOAA. The regulation of coastal infrastructure is often collaborative between CZM programs, federal agencies, port authorities and municipalities, depending on the location and jurisdiction. Other coastal areas and structures such as parks and lighthouses are managed by the USCG and the National Park Service for historic preservation and recreation.

Ports are vital economic hubs that import and export significant quantities of goods every day. Container ports, as well as terminals for petroleum products or other goods that cannot be transported in container ships, can be public terminals operated by port authorities or private terminals. Ports include a variety of infrastructure, including storage facilities and railroad or roadway connections. Most major ports also have crane installations as well as conveyor systems for loading.

Offshore infrastructure connects and relies on onshore activities and infrastructure. For oil and gas projects or renewable energy development, these activities include providing for construction or fabrication and staging of projects and platforms before using port infrastructure to deliver materials to the installation site offshore. Ports serve a role in provisioning workers and general operation and maintenance activities for offshore infrastructure after installation. Other onshore infrastructure, including landing stations, connects submarine cables to onshore cabling and electricity grids.

## *3.11.2 Past and Present Activities*

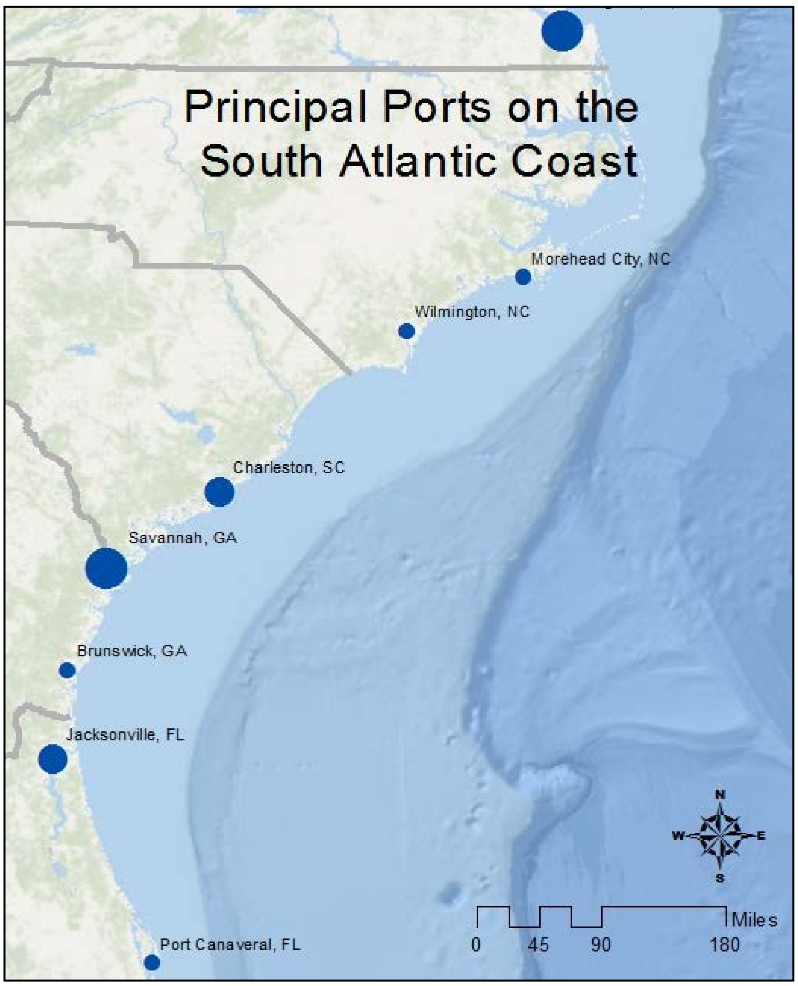
Every state along the South Atlantic coast has a NOAA-approved Coastal Zone Management Program (CZMP). The scale (i.e. how much area inland) that is covered varies by state. These programs were approved by NOAA in the late 1970s and 1980s and are administered by state agencies (NOAA 2018f). Many CZMPs require planning and implementation for coastal and port infrastructure in collaboration with other entities (NOAA 2018f).

In 2015, NOAA estimated that of the almost 44 million people living in the states of North Carolina, South Carolina, Georgia, and Florida, 41% reside in coastal counties (NOAA 2016). Developed lands in the region increased by 20% between 1996 and 2010 (NOAA 2010a). The largest population centers along the South Atlantic coast between North Carolina and central Florida (the boundary of the AOI is roughly Port Canaveral) include: Wilmington, North Carolina (2018 population estimate: 123,000); Charleston, South Carolina (2018 population estimate: 136,000); Savannah, Georgia (2018 population estimate of 146,000); and Jacksonville, Florida (2018 population estimate: 900,000) (US Census 2019).

NOAA reports that ocean-dependent activities, including commercial fishing, tourism and recreation, and shipping support over 324,000 jobs, $8.1 billion in wages, and $17.6 billion in GDP (NOAA 2016). The marine transportation sector, spread across 35 ports and terminals that service cargo and passenger ships, comprised 9% of the region's ocean-dependent jobs and 17% of GDP (NOAA 2016). As of 2018, two of the ten largest metropolitan areas in the United States are within the Southeast U.S. Atlanta with a metropolitan population of roughly 5.9 million and Miami with a metro population of 6.2 million, though both are outside the AOI (US Census 2019).

Four of the top 25 tonnage, container, and dry bulk ports are located on the Atlantic coastline of North Carolina, South Carolina, Georgia, and Florida. In particular, port activity in the southeast is concentrated in seven principal ports along the South Atlantic coast, include Morehead City, North Carolina; Wilmington, North Carolina; Charleston, South Carolina; Savannah, Georgia; Jacksonville, Florida; and Port Canaveral, Florida. The ports and relative tonnage are presented in Figure 3-20 (USACE 2018a; b). Over time, the total tonnage for these ports has increased since the recession but is lower than it was in 2007; Table 3-24 and Figure 3-21 present the total tonnage in thousands of short tons by port from 2007 to 2016 for these seven ports (see section 3.6 for information on marine vessel traffic trends). The port of Virginia (including Hampton Roads and Norfolk International Terminal) and the Norfolk Naval Base, just north of North Carolina, are also a hub of marine and naval traffic as well as port activities. Additional information on port and marine vessel traffic in the Atlantic north of North Carolina can be found in BOEM 2019a.

**Figure 3-20. Principal Ports on the South Atlantic**



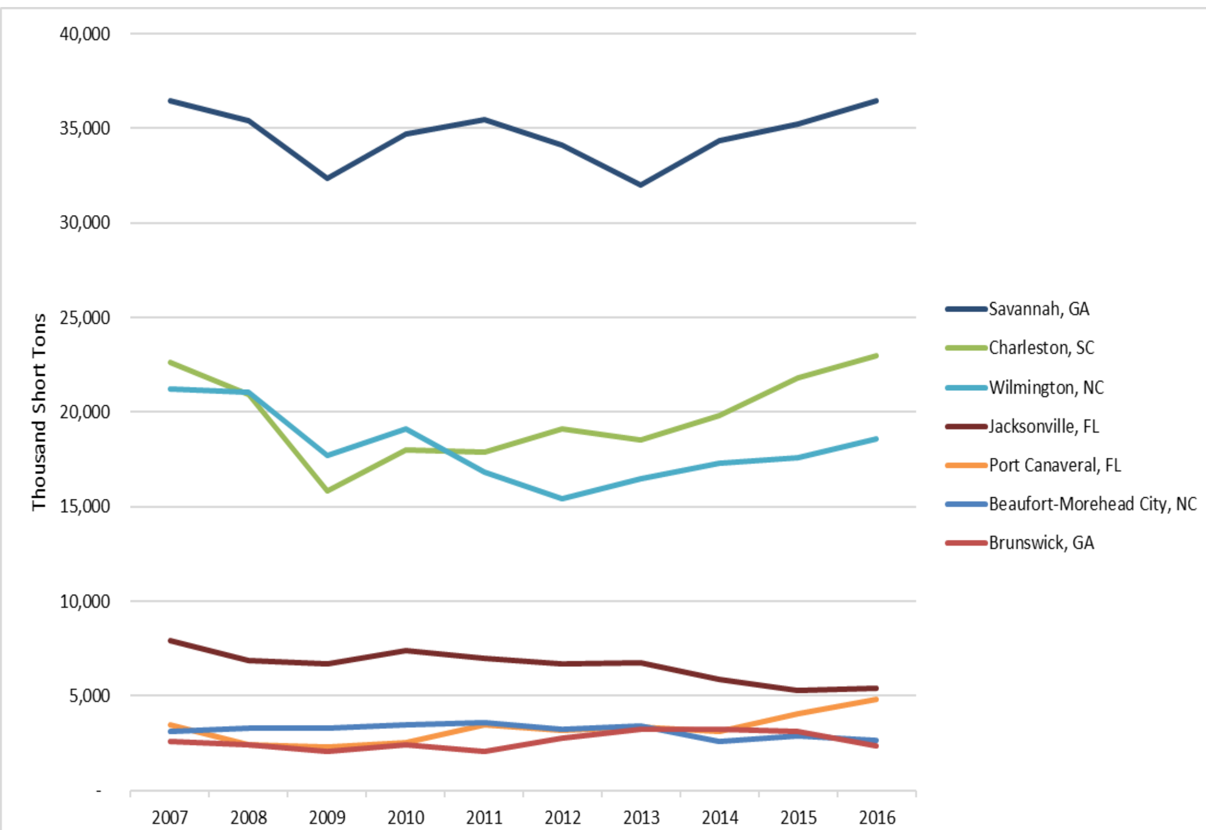

Note: Size indicates total commodity tonnage in tons
Source: USACE 2018a; 2018b

**Table 3-24. Total Commodity Tonnage (Thousand Short Tons) at the Principal Ports in the South Atlantic, 2007-2016**

| Port | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 |
|---|---|---|---|---|---|---|---|---|---|---|
| Savannah, GA | 36,486 | 35,394 | 32,339 | 34,682 | 35,459 | 34,132 | 31,990 | 34,359 | 35,205 | 36,444 |
| Charleston, SC | 22,616 | 20,936 | 15,834 | 17,986 | 17,917 | 19,105 | 18,525 | 19,847 | 21,811 | 23,016 |
| Wilmington, NC | 21,216 | 21,057 | 17,691 | 19,122 | 16,831 | 15,439 | 16,473 | 17,319 | 17,607 | 18,575 |
| Jacksonville, FL | 7,930 | 6,872 | 6,716 | 7,428 | 6,973 | 6,719 | 6,778 | 5,888 | 5,317 | 5,415 |
| Port Canaveral, FL | 3,470 | 2,431 | 2,301 | 2,510 | 3,462 | 3,164 | 3,337 | 3,149 | 4,067 | 4,827 |
| Beaufort-Morehead City, NC | 3,108 | 3,300 | 3,278 | 3,498 | 3,570 | 3,249 | 3,426 | 2,624 | 2,896 | 2,641 |
| Brunswick, GA | 2,587 | 2,444 | 2,094 | 2,438 | 2,054 | 2,752 | 3,228 | 3,252 | 3,108 | 2,375 |
| **Total** | **97,413** | **92,435** | **80,253** | **87,663** | **86,265** | **84,560** | **83,758** | **86,438** | **90,010** | **93,292** |

Source: USACE 2018b

**Figure 3-21. Total Commodity Tonnage (Thousand Short Tons) at Ports in the South Atlantic, 2007-2016**




Source: USACE 2018b

As of 2014, there were no oil and gas platform fabrication yards or pipeline production facilities in the Atlantic from North Carolina to Florida. There were seven inactive oil and gas wells off the South Atlantic from North Carolina to Florida in the Jacksonville, Florida protraction area (a grouping of OCS lease blocks) (BOEM 2014d). The U.S. Department of Energy conducted an assessment of current port infrastructure for offshore wind energy development. The report identifies that in order to support future wind development activities, the South Atlantic would require at least one staging port for wind energy development. The report also suggests that regional ports would require infrastructure installations including increased bearing capacity to accommodate the larger and heavier turbines coming into production (DOE 2014). For offshore wind energy development, the BOEM North Carolina Commercial Wind Lease EA identified five existing "major" ports that could support meteorological tower and buoy installation activities: Norfolk, Virginia, Wilmington and Morehead City, North Carolina as well as Charleston and Georgetown, South Carolina (BOEM 2015).

The USCG maintains a listing of all coastal light sources (USCG 2018),[10] which includes the location of onshore and offshore navigation structures (e.g. buoys, markers and lighthouses). Public listings of lighthouse resources are also available that include directories and maps from both government and private citizen efforts. The majority of lighthouses along the south Atlantic coast are in Florida and South Carolina with 29 and 11, respectively (U.S. Lighthouse Society 2018).[11] Seven Atlantic lighthouses along the eastern coastline of North Carolina, South Carolina, Georgia, and Florida are designated as historical locations as part of the National Historic Lighthouse Preservation Act (NPS 2018b). The National Park Service also identifies 22 maritime-related national parks in the Southeast Atlantic region (NPS 2018a). These include the Cape Hatteras National Seashore, Canaveral National Seashore, the Gullah/Geechee Cultural Heritage Corridor (which runs from Jacksonville to Wilmington, North Carolina), Fort Sumter National Monument and other recreation areas but they are not all coastal areas.

### *3.11.3 Reasonably Foreseeable Future Activities*

Infrastructure developments and port improvements are funded and approved by a variety of agencies at both the federal and state level as well as by port authorities directly. Additional port and coastal infrastructure would likely require investment, permitting, and review by these state and federal authorities. The DOT Port Performance Report, published every year, contains statistics and proposed updates as well as the relevant investments (DOT 2018; 2019). Table 3-25 presents the most recent reports (updated in February 2018 and April 2019) identifying foreseeable port developments at the largest Atlantic ports by cargo volume. Additional maintenance dredging or other minor facility upgrades could also occur periodically at these ports in the future; these activities are not included in Table 3-27.

Increases in marine navigation, fishing and offshore energy development would increase the use of onshore infrastructure and port facilities. Wind energy turbine construction would necessitate additional usage of port areas and infrastructure. In 2013, the city of Charleston, South Carolina signed a resolution to support and encourage future developments in offshore wind energy off the South Carolina coast. Specifically, the City acknowledged that the port facilities of Charleston, Mt. Pleasant, and North Charleston may serve as a gateway for the growing global wind energy market (City of Charleston 2013). As of November 2019, there is a single WEA leased off North Carolina (Kitty Hawk WEA).

[10] The USCG lighting list can be found here: https://www.navcen.uscg.gov/?pageName=lightLists
[11] For directories and listings of lighthouses: https://uslhs.org/resources/lighthouse-directories-organizations/directories

**Table 3-25. Foreseeable Future Port Development at Large South Atlantic Coast Ports**

| Port | Updates |
|---|---|
| Charleston (SC) | The South Carolina Ports Authority (SCPA) is currently building a new, 280-acre container terminal in North Charleston. It is scheduled to be completed in 2020 with the first phase opening in 2021. SPCA has recently completed improvements to the Wando Welch Terminal wharf to better handle super-post Panamax vessels. SPCA also anticipates future investments for modernization of both the Wando Welch and North Charleston terminals, including expanding cold storage facilities by 50%. Additionally, USACE is overseeing a project to deepen the Charleston harbor inner channel to 52 feet, expected to be completed in 2020. |
| Jacksonville (FL) | The Port of Jacksonville is coordinating with USACE to complete a channel dredging project that will deepen the harbor to 47 feet. The channel deepening is expected to be completed in 2023 or 2024. In 2016, the port opened the Intermodal Container Transfer Facility, which has brought near-dock rail access to the Blount Island Marine Terminal and Dames Point and additional improvements of the Blount Island terminal will occur (following the deepening project) to improve deep-water berthing (Jaxport 2019b). |
| Savannah (GA) | The Port of Savannah is coordinating with USACE to deepen Savannah Harbor to 47 feet by 2022. The port is also expanding the Garden City Terminal's rail capacity, partly supported by a $44 million federal transportation grant. The port received four new cranes in 2017 and anticipates receiving six more new cranes in 2020. Overall, these projects (called the Savannah Harbor Expansion Project) aim to double the capacity of the port (Georgia Ports 2019). |
| Wilmington (NC) | In 2018, the Port of Wilmington received two new super post-Panamax cranes to augment the existing four. Additionally, the North Carolina Ports Authority reached an agreement in 2017 to begin daily double-stacked rail service between the port of Wilmington and an intermodal facility in Charlotte, NC. |

Source: DOT 2018; 2019

A DOE assessment report in 2014 (DOE 2014) used the Port of Morehead City (North Carolina) as a case study to estimate the capacity for offshore wind development in the South Atlantic region in the next 10-20 years (i.e. by 2030). The study found that the improvements needed at the Port of Morehead City were minimal and related to increasing the soil bearing capacity of the haul route. If the necessary improvements are carried out, the report predicts that one port such as Morehead City would be able to satisfy the necessary port infrastructure requirements to support the targeted offshore wind capacity development in the South Atlantic region. However, it is anticipated that multiple staging ports would be utilized in order to minimize transit differences (DOE 2014). The report also found that most regional ports were capable of supporting O&M activities for wind energy development (DOE 2014). Such O&M activities, in addition to the port improvements and development discussed above, could require ongoing dredging and maintenance at various facilities. For example, maintenance dredging is often required to allow ships to access port facilities as well as seabed improvement to ensure that seabed soil is strong enough for vessels that raise turbine materials (DOE 2014). DOE recommends that ports and facilities used for operations and maintenance activities be accessible 100 percent of the time and avoid any tidal or structural limitations.

There is also the potential, given the increasing size of offshore wind turbines that there are additional improvements that would be required. The DOE review evaluated 8MW turbines, while the largest turbines nearing production (the GE Haliade-X), as of November 2019, are up to 12MW (DOE 2014, Windpower Monthly 2019).

### *3.11.4 Impact-Producing Factors Associated with Land Use and Coastal Infrastructure*

The reasonably foreseeable impacts of land use and onshore infrastructure activity IPFs that could overlap with offshore wind energy development IPFs include the following:

- Accidental releases, fuel/fluids/hazmat

- Air emissions, onshore
- Discharges, onshore point source and non-point sources
- Presence of structures, viewshed
- Traffic, vessels.

IPFs associated with land use and onshore infrastructure that have no material overlap with IPFs of offshore wind energy development include:

- Land disturbance, erosion and sedimentation
- Land disturbance, onshore, land use changes
- Light, structures, onshore
- Noise, pier and infrastructure, development
- Traffic, onshore.

# 4. CUMULATIVE IMPACTS ON AFFECTED RESOURCES

## 4.1 CUMULATIVE IMPACTS SCENARIO IPFS THAT INTERACT WITH OFFSHORE WIND ENERGY

Table 4-1 provides an overview of the IPFs from the actions included in the cumulative impacts scenario. These include IPFs that result from offshore wind energy development as well as IPFs from other activities that affect the same resources as offshore wind energy development. Compiling IPF information from past NEPA reviews for wind energy development projects was not straightforward. Often, past NEPA reviews for wind energy development used different terms to describe IPFs, e.g., “decommissioning” versus “platform removal.” We also found that past EIS’s defined IPFs differently, with some documents identifying IPFs that could more strictly be considered as impacts and not as factors that produce impacts, e.g., “benthic disruption or destruction” was identified as an IPF and not “benthic trawling.”

One objective of this project is to increase the consistency in BOEM’s future NEPA review documents. Our review of past NEPA documents for wind energy projects identified a large number of IPFs, many of which overlapped with each other. Eliminating duplicate IPFs resulted in 97 unique IPFs. These IPFs were then grouped by type into a list of 28 primary IPFs as shown in the first column of Table 4-1 and Table 2-1. Of these, 12 IPFs result directly from wind energy development, and 16 additional IPFs affect the same resources that are affected by wind energy development, as shown in Table 4-1.

Although climate change is not an action, its reach touches nearly all actions discussed in Chapter 3 and thus the affected resources described below. Climate change is altering the baseline against which the impacts of human actions are measured. Climate change is included in the tables that follow as an action and has IPFs that interact with those of Outer Continental Shelf (OCS) wind development to potentially affect resources. The tables that follow include IPFs under the climate chance action that are not directly produced by climate change but may be affected or altered by climate change.

**Table 4-1. Cumulative Impacts Scenario IPFs**

| | Dredge Material Ocean Disposal | Commercial and Recreational Fishing | Land Use /Coastal Infrastructure | Marine Minerals Extraction | Marine Transportation, Navigation, and Traffic | Military Ranges & Civilian Space Program Uses | Oil and Gas Surveys and Extraction | Renewable Energy-Wind | Submarine Cables, Lines, & Pipelines | Climate Change |
|---|---|---|---|---|---|---|---|---|---|---|
| **Offshore Wind Energy Development IPFs** | | | | | | | | | | |
| Accidental releases | ● | ● | ● | ● | ● | ● | ● | ● | ● | |
| Air emissions | ● | ● | ● | | ● | ● | ● | ● | ● | |
| Anchoring | | | | | | ● | ● | ● | | |
| Discharges | ● | ● | ● | ● | ● | ● | ● | ● | ● | |
| Electromagnetic fields | | | | | | | | ● | ● | ● |
| Energy generation, energy security | | | | | | | | ● | | ● |
| Light | | ● | ● | | ● | ● | ● | ● | | |
| New cable emplacement/maintenance | | | | | | | | ● | ● | ● |
| Noise | ● | ● | ● | ● | ● | ● | ● | ● | ● | |
| Port utilization | ● | | | | ● | | ● | ● | | ● |
| Presence of structures | | | ● | | | ● | ● | ● | ● | ● |
| Traffic | ● | ● | ● | ● | ● | ● | ● | ● | ● | |

**Table 4-1. Cumulative Impacts Scenario IPFs**

| | Dredge Material Ocean Disposal | Commercial and Recreational Fishing | Land Use /Coastal Infrastructure | Marine Minerals Extraction | Marine Transportation, Navigation, and Traffic | Military Ranges & Civilian Space Program Uses | Oil and Gas Surveys and Extraction | Renewable Energy-Wind | Submarine Cables, Lines, & Pipelines | Climate Change |
|---|---|---|---|---|---|---|---|---|---|---|
| **Cumulative Impact Scenario, Other IPFs** | | | | | | | | | | |
| Beach restoration | ● | | | ● | | | | | | ● |
| Bycatch | | ● | | | | | | | | |
| Demolition/structure removal | | | | | | ● | ● | | | |
| Energy stressors/devices/lasers | | | | | | ● | | | | |
| Gear utilization | | ● | | ● | | ● | | | | ● |
| Guidance/fiber optic wires, entanglement | | | | | | ● | | | | |
| Ingestion | | | | | | ● | | | | |
| Land disturbance | | | ● | | | | ● | | | ● |
| Ocean acidification | | | | | | | | | | ● |
| Port utilization, maintenance, dredging | ● | | | | ● | | | | | ● |
| Pipeline trenching | | | | | | | ● | | | |
| Regulated fishing effort | | ● | | | | | | | | ● |
| Resource exploitation | | ● | | | | | | | | ● |
| Sediment deposition and burial | ● | | | | | | | | | ● |
| Seabed profile alterations | | | | ● | | | | | | ● |
| Warming and sea-level rise | | | | | | | | | | ● |

Due to the lack of any ongoing or reasonably foreseeable activity, geosequestration, LNG terminals, and tidal energy projects were excluded from the cumulative impact scenario for South Atlantic OCS wind energy development activities. They are not further discussed in this chapter.

With respect to offshore wind energy development, BOEM considers state demand as reasonably foreseeable only to the extent that the lease area available to that state can support the published state demand. Using this metric, the 18 projects BOEM has included in its 17 GW scenario that are listed in Table 3-7 include 17 projects located along the Atlantic coast from Maine through Virginia. One project, Avangrid, is located offshore North Carolina but there is no awarded offtake or power purchase agreement. In the South Atlantic AOI there are no state capacity commitments, i.e., no procurements awarded, announced, or planned; no offshore wind solicitations awarded or announced; no COPs approved, submitted, or announced; and no offshore wind offtake awarded. WEAs in the South Atlantic, offshore North Carolina, South Carolina, Georgia, and Florida, currently are not considered reasonably foreseeable because there is no state demand from neighboring locations, submitted COPs, PPAs, or announced projects.

As mentioned above, the only active wind energy lease in the South Atlantic AOI is Avangrid’s Kitty Hawk wind farm. Given the current status of this effort, even with BOEM’s expanded criteria for considering projects as reasonably foreseeable, BOEM does not consider this project reasonably foreseeable for purposes of defining the cumulative impacts scenario related to wind development. Regardless, the remainder of this chapter discusses the potentially affected physical, biological, and socioeconomic/cultural resources and the potential impacts associated with the cumulative impacts scenario should future offshore wind energy development occur in the South Atlantic AOI.

## 4.2 ADDITIONAL POTENTIAL SOURCES THAT MAY INTERACT WITH WIND ENERGY-RELATED IPFS

In addition to the actions listed above, there are minor, infrequent, or intermittent sources of IPFs that occur. These IPFs have the future potential to interact with the cumulative impacts scenario for wind development projects or may occur at a level significant enough to be considered in the cumulative impacts scenario. A few examples are briefly discussed below.

### *Natural releases*

Methane, a potent greenhouse gas, seeps occur in deep waters along the Atlantic shelf more than 100 km from shore. There are hundreds of seeps along the shelf from Georges Bank to Cape Hatteras. The methane from these seeps is oxidized into carbon dioxide in the water column and plays a role in oceanic cycling of carbon (USGS 2016).

### *Discharges*

Offshore fish processing currently is not practiced off the Atlantic coast. If such fish processing vessels begin operating off the Atlantic coast their impacts could materially contribute to cumulative discharges for consideration.

### *Electromagnetic fields and new cable emplacement and maintenance*

Construction of monitoring or tracking installations for the purpose of homeland security have not been included in the cumulative impacts scenario. These activities could contribute to electromagnetic fields or cabling to the AOI.

### *Research Surveys*

Research surveys conducted by federal agencies, universities, and research organizations can contribute to the impacts produced by G&G surveys covered in this cumulative impacts scenario. Research activities that require mooring activities or other devices deployed could also contribute to impacts.

### *Noise*

Ambient sound in the ocean is derived from waves, wind, and animal communication. NOAA has deployed sound monitoring stations to determine background noise levels, including one project to examine deep water ecosystems including the soundscape in the Mid and South Atlantic. This project is called the Atlantic Deepwater Ecosystem Observatory Network (ADEON) and is a joint research effort between various agencies and academic organizations (UNH 2019).

## 4.3 CUMULATIVE IMPACTS OF IPFS ON POTENTIALLY AFFECTED RESOURCES

In this section, IPFs from all the actions and activities covered under the cumulative impacts scenario are described for the potentially affected resources within scope, which include the following 19 resources:

**Physical Resources**

- Acoustic Environment
- Air Quality
- Mineral Resources
- Water Quality

**Biological Resources**

- Birds and Bats
- Coastal Habitats
- Benthic Communities
- Fish, Essential Fish Habitat, and Threatened and Endangered Fish
- Marine Mammals
- Sea Turtles
- Areas of Special Concern

**Socioeconomic & Cultural Resources**

- Demographics, Employment, Economics, and Environmental Justice
- Cultural and Historic Resources
- Visual Resources
- Tourism and Recreation
- Commercial and Recreational Fishing
- Land Use and Infrastructure
- Military Range Complexes and Civilian Space Programs
- Marine Transportation, Navigation, and Traffic
- Energy Production and Distribution

For each resource, the impacts of each of the 10 actions/activities of the cumulative impacts scenario (renewable energy-wind, renewable energy-hydrokinetic, marine minerals extraction, dredge material ocean disposal; military range complex/civilian space program use, marine transportation and navigation, commercial and recreational fishing, oil and gas surveys and extraction, seabed lines/cables/pipelines, and land use and coastal infrastructure) are discussed below. The interaction between OCS wind energy development and each of the other actions and activities is noted.

### *4.3.1 Physical Resources*

#### *4.3.1.1 Acoustic Environment*

**Table 4-2. Cumulative Impacts Scenario IPFs – Acoustic Environment**

| | Dredge Material Ocean Disposal | Commercial and Recreational Fishing | Land Use /Coastal Infrastructure | Marine Minerals Extraction | Marine Transportation, Navigation, and Traffic | Military Ranges & Civilian Space Program Uses | Oil and Gas Surveys and Extraction | Renewable Energy-Wind | Submarine Cables, Lines, & Pipelines | Climate Change |
|---|---|---|---|---|---|---|---|---|---|---|
| **Offshore Wind Energy Development IPFs** | | | | | | | | | | |
| Energy generation, energy security | | | | | | | | ● | | ● |
| New cable emplacement/maintenance | | | | | | | | ● | ● | ● |
| Noise | ● | ● | ● | ● | ● | ● | ● | ● | ● | |
| Port utilization | ● | | | | ● | | ● | ● | | ● |
| Presence of structures | | | ● | | | ● | ● | ● | ● | ● |
| Traffic | ● | ● | ● | ● | ● | ● | ● | ● | ● | |
| **Cumulative Impact Scenario, Other IPFs** | | | | | | | | | | |
| Beach restoration | ● | | | ● | | | | | | ● |
| Demolition/structure removal | | | | | | ● | ● | | | |
| Energy stressors/devices/lasers | | | | | | ● | | | | |
| Gear utilization | | ● | | ● | | ● | | | | ● |
| Land disturbance | | | ● | | | | ● | | | ● |
| Port utilization, maintenance, dredging | ● | | | | | | | | | ● |
| Pipeline trenching | | | | | | | ● | | | |
| Resource exploitation | | ● | | | | | | | | ● |
| Seabed profile alterations | | | | ● | | | | | | ● |
| Warming and sea level rise | | | | | | | | | | ● |

The acoustic environment can affect multiple biological and socioeconomic resources. Considered as a resource itself, offshore wind energy development IPFs that can affect the quality of the acoustic environment include: noise generated during site characterization (G&G) surveys, construction of data collection and wind turbine structures, emplacing submarine transmission lines, O&M of data collection and wind turbine structures, decommissioning/ structure removal, port utilization activities, and vessel traffic related to G&G surveys, construction/ installation, O&M, and decommissioning. HRG surveys that don't use air guns greatly reduce impacts from G&G survey activities.

Among these, the most intense impact on the acoustic environment occurs as impulsive noise during pile driving to support meteorological towers and wind turbine structures. However, several mitigation measures reduce the potential impact of noise from pile driving activity (e.g., "soft" starts and seasonal restrictions) and pile driving only occurs during the construction/installation phase for wind energy structures. In contrast, noise impacts on the acoustic environment associated with wind energy-related vessel traffic are continuous and far less intense but still contribute to the overall occurrence of noise in the marine environment.

The resources most affected by noise include marine mammals, sea turtles, fisheries, and to a lesser extent, birds and bats. Acoustic impacts are manifest at several levels. Hearing threshold shifts involve temporary or permanent reductions in hearing ability. Temporary threshold shifts (TTS) is temporary and recoverable damage to hearing structures; it can vary in intensity and duration. Normal hearing abilities return over time from TTS; animals may not detect prey or predators during the recovery period. Permanent threshold shifts (PTS) result in variable but permanent hearing loss.

Masking occurs at sound levels below those that cause TTS or PTS impacts. Natural or anthropogenic acoustic input may be sufficient to interfere with hearing relevant sounds or induce evasive behavior. Masking sound can interfere with finding prey or mates, avoiding predators, and identifying appropriate nesting sites in the case of sea turtles. Animals can respond to acoustic inputs with behavioral responses, such as fleeing, diving, or changing swimming direction or speed. If sufficiently powerful, acoustic signals can cause physical injury, such as occurs with PTS and mortality.

Two studies have examined ambient noise in the North, Mid-, and South Atlantic and have analyzed species occurrence and migration patterns to establish some baseline conditions. BOEM (2014c) provides a statistical description of ambient sound levels for one year offshore Delaware Bay and Nantucket Sound.

Anthropogenic sources and natural sources were found at each site throughout the year. Sound levels exceed maximal predictions of the Wenz curves for heavy shipping and large storms at lower frequencies (<100 Hz) and biological fish choruses at higher frequencies (200–4000 Hz). Biological sound activity included marine mammals and fish. Delphinids and fin whales were the most commonly detected marine mammals at the Delaware Bay site. North Atlantic right whale calls were detected on a few occasions at both sites. Humpback whale call detections occurred only at the offshore Delaware Bay site. Although North Atlantic right whale calls were detected at the Nantucket site for a few hours in April 2011, marine mammals were essentially absent from this site. Fish choruses were heard in late summer and fall offshore Delaware Bay and in winter and summer at Nantucket Sound. These events occasionally exceeded the Wenz curves.

The authors suggested future development offshore Delaware Bay should consider the presence of endangered North Atlantic right, fin, and humpback whales mainly from January to March (although see BOEM [2015a] below). The authors also noted that work is needed to identify the fish species whose calls were detected at the Nantucket site in winter to determine if these temporal presence/occurrence data are useful for commercially important species.

BOEM (2015a) conducted a baseline study of marine mammals and fish at two wind energy planning areas that are part of the Beaufort North Carolina (within Onslow Bay) and Brunswick Georgia (within the Georgia Bight) lease areas, from June 2012 to April 2013. Rice et al. also considered the ambient noise data acquired provide a baseline so that any contributions to future baseline noise from increases in ship traffic, construction, and wind farm operations can be measured and potential impacts assessed.

Long duration (multiple weeks or months) spectrograms and power spectra were used to evaluate ambient noise conditions. Summer and fall months (June/November) had higher levels of noise than winter and spring months (December/April). The Georgia location had higher noise levels than in North Carolina. Sources at both locations included: weather and biological, anthropogenic, and unknown sources. Fish chorusing was the dominant biological sound source; several unknown sound sources, potentially biological, made significant contributions to ambient noise. Marine mammal vocalizations were recorded throughout the study but occurred too infrequently to be detected on long term spectrograms.

The authors detected North Atlantic right whales throughout the study, with peak presence November/April. Presence between January and March decreased in Georgia while increasing in North Carolina, corresponding to right whale migration. An unexpected secondary peak of right whale presence occurred in June and July in the Georgia site. The authors also noted that right whale daily presence outside of November 1-to-April 30 Mid-Atlantic seasonal management period was 14% in North Carolina and 29% in Georgia. These data suggested North Atlantic right whales may occur in this region more often than previously documented. Multiple years of acoustic surveys are needed to decide if these results are an aberration or an annual pattern of occurrence. A significant presence of fin whales or humpback whales was not detected in Georgia or North Carolina. Humpback whale vocalizations were found on 8 days and 12 days in Georgia and North Carolina, respectively, but primarily in December 2012.

Black drum and oyster toadfish were acoustically detected over differing time periods at the North Carolina and Georgia sites. Black drum are predominantly present in fall/spring (November/April). Oyster toadfish are predominantly present in the early spring/summer (March/April and June/August). Based on the lower acoustic occurrence of black drum and toadfish in North Carolina, these two species would not be effective indicator species at this site. At the Georgia site, black drum and oyster toadfish may be good indicators of environmental change.

### *Dredged material ocean disposal*

The contribution of ocean disposal to the acoustic environment primarily is noise from vessel operations, which may interact with noise from wind energy-related vessel traffic and construction. There are 8 active projects and 8 inactive/closed projects identified in the South Atlantic coastal states (North Carolina to Florida; Table 3-10). EPA noticed a trend in ocean disposal of dredge material that showed decreases in ocean dumping and increased focus on beneficial reuse. USACE reported that about 20% to 30% of port and waterway dredged material is used for habitat creation and other beneficial uses. However, USACE has identified the Southeast coast ports as top candidates for economically justified port expansion/dredging projects to construct ports capable of handling post-Panamax vessels, suggesting dredge spoil generation may increase in the AOI. Given the two opposing trends of increased port channel-related dredging activity and increased use of dredge spoil for beneficial uses, BOEM expects ocean disposal activity to remain stable or increase.

### *Commercial and recreational fishing*

In 2017, commercial fisheries harvested approximately 194 million pounds of fish and shellfish in the four-state region (including North Carolina, South Carolina, Georgia and Florida), with a total landed value of over $397 million (2018 dollars); over the period from 2008 to 2017, average annual landings were 190 million pounds with a value of $376 million (NOAA 2019d). The top five species by landing value in 2017 for the four-state region included for the four-state region included white shrimp, blue crab, Caribbean spiny lobster, pink shrimp, and stone crab (NOAA 2019d). Total values and pounds landed over the past ten years are shown in Figure 3-11, based on data from NOAA Fisheries. Between 2008 and 2017, the value of landings ranged from $305 million to $431 million, while landings weight ranged from 179 million pounds to 210 million pounds. Vessel traffic from commercial and recreational fishing is a significant contributor to overall vessel traffic along the South Atlantic coast but is expected to remain stable for the foreseeable future.

### *Land use and coastal infrastructure*

Land use on the South Atlantic coast is diverse, encompassing many distinct environments, supporting a wide range of ecosystems, and human activities including recreation, tourism, residential, commercial, and industrial infrastructures. The impact of wind energy development on land use requirements primarily relates to the increase in port activity required to meet the demands for fabrication, construction, transportation, installation, and maintenance of wind energy structures and contributing to the need for maintenance dredging. In addition, offshore wind energy development will require operations and maintenance facilities and their associated land use, construction, maintenance, and infrastructure and utilities support. Connections to the power grid also may impact local land use and development.

A DOE assessment report in 2014 used the Port of Morehead City, North Carolina as a case study to estimate the capacity for offshore wind development in the South Atlantic region in the next 10-20 years. The report concluded needed improvements were minimal and if made that one port such as Morehead City would be able to satisfy the port infrastructure requirements to support offshore wind capacity development in the region. That said, DOE also anticipated multiple staging ports would be utilized to minimize transit differences. Also, given the increasing size of offshore wind turbines there may be additional improvements required.

Impacts will be spatially limited to the area near ports. The incremental increase in noise from offshore wind development vessel activity is expected generally to be a minor contributor to overall port activity compared to commercial, industrial, and recreational inputs. However, the smaller the port that is used to support OCS wind energy development, the greater the potential incremental impact may be. Therefore, the smaller the port the more that baseline levels of vessel traffic and commerce need to be considered to assess properly the significance of the incremental contribution of wind energy development to the local acoustic environment.

### *Marine minerals extraction*

Data on projected sand mining activity, based on current lease agreements, indicate a stable or slightly increasing trajectory through 2020. There are two active leases both of which are located offshore Brevard County, Florida and one lease request that is offshore Flagler County, Florida. There is currently one large (2.2 million cu yd) active lease located off Virginia Beach, Virginia. The lease is less than 50 km from the North Carolina border and could potentially interact with wind energy development activities in the northern areas offshore North Carolina.

States also have active minerals mining and channel dredging activities that support numerous local beach renourishment projects. However, the type and availability of data on these projects vary widely at the state and county level. Evaluating the potential interactions with offshore wind energy development and such local projects appears to require real-time effort at state- and county-level offices. The Army Corps of Engineers (USACE 2020).may have the most comprehensive source of information on these local projects at its USACE Jurisdictional Determinations and Permit Decisions website: https://permits.ops.usace.army.mil/orm-public.

Noise from vessel traffic and dredging occur under limited spatial and temporal conditions. Project-level dredging activities and wind energy construction and installation activities are typically relatively short-term efforts–one or two years. However, dredging for a series of beach restoration projects is possible and could result in longer-term impacts. Thus, specific minerals mining projects need to be assessed if the wind energy lease is near active borrow sites. Marine minerals mining may also require G&G activities that are similar, although much less extensive, to wind energy G&G surveys and wind energy related impacts. These impacts on the acoustic environment are related to noise from both vessel traffic and operational noise e.g., HRG surveys. The interaction of minerals mining and wind energy G&G surveys will be temporally limited and could be scheduled to be avoided. These surveys can be spatially extensive, but they are of relatively short duration and could be scheduled to avoid overlapping impacts to the acoustic environment.

### *Marine transportation*

Marine transportation in the South Atlantic region is diverse. It includes: cargo; tug/barge; liquid tanker; dredging; underwater/diving operations; military operations, training, and testing; scientific research; search-and-rescue vessels, and recreational traffic. Commercial and recreational fishing are discussed in detail as a separate element in the cumulative impact scenario on Chapter 3.7.

Vessel call volume remained relatively steady from 2006 to 2015, with no discernible trend, as illustrated in Table 3-17 for all ports and terminals in the South Atlantic and in Figure 3-9 for the five busiest South Atlantic ports. However, USACE has identified the Southeast coast ports as top candidates for economically justified port expansion projects to improve ports capable of handling post-Panamax vessels. Port expansion would involve dredging deeper channels and increasing the size and capabilities of port equipment, e.g., larger winches and cranes and associated power upgrades. If this improvement occurs commercial ship traffic in the Southeast may see a future increase.

Marine transportation IPFs that potentially interact with OCS wind energy development include accidental releases, air emissions, discharges, noise, port utilization, presence of structures/offshore space use conflicts, vessel traffic, and vessel noise. The interacting IPFs that are important to the acoustic environment are primarily vessel traffic and vessel noise. Vessel activity from wind energy leases near marine transportation routes may interact to increase overall noise in the vicinity of the WTGs. The level of activity would be greatest during construction but would continue at a lower level from maintenance activities or /emergency trips and for G&G surveys. However, wind energy vessel activity is small portion of overall marine traffic. Interactions with G&G surveys are of limited durations, which reduces their potential interaction with marine transportation to cause impacts on the acoustic environment,

Noise related to wind energy construction could interact with marine vessel traffic but only to a limited temporal and spatial degree, also reducing potential acoustic impacts. Wind energy development could potentially impact shipping fairways, traffic lanes, and anchorage areas and increase noise near these areas, which already are subject to heavy marine traffic, or cause them to use other routes, bringing their acoustic impacts into new areas. This concern, however, should be addressed in the scoping and public comment phases of the offshore wind energy leasing process.

### *Military use, military range complexes, civilian space programs*

The Navy represents a significant extensive military use of the coastal and offshore environment; NASA leads the civilian space program’s use offshore Virginia, near the northern border of the South Atlantic AOI, and in the South Atlantic AOI offshore Cape Canaveral, Florida. Military use of coastal and offshore areas is not restricted to the Navy; the Coast Guard, Marines, Air Force, and Army all utilize these areas for operations, training, and testing.

The Navy released its Final EIS on its Atlantic fleet training and testing in September 2018. The Navy determined training and testing activities have the potential to expose marine biota to multiple acoustic stressors that could produce temporary or permanent hearing threshold shift, auditory masking, physiological stress, or behavioral responses. However, acoustic stressors are unlikely to incur substantive costs at the individual or populations level because Naval activities are widely distributed over the Atlantic coast and are intermittent. Thus, individual animals typically would experience a small number of behavioral responses or temporary hearing threshold shifts per year.

There is always substantial uncertainty in predicting the levels of military use of the range complexes in the future as world events unfold. In the near term, the level of military activity will likely remain relatively stable in the AOI, although fiscal trends are placing downward pressure on these activities. Civilian space program uses in the region may increase above the present level given the recent expansion of commercial interest in space travel and privatization of previously government responsibilities.

### *Oil and gas surveys and extraction*

The Atlantic has seen minimal oil and gas development interest and activity from the 1970s through the present: between 1979 and 1984 eight exploratory wells were drilled with no economically viable discoveries. The current five-year OCS oil and gas lease sale plan has no lease sales scheduled through 2022. Any projections for future leasing in the Atlantic would be speculative. Therefore, the cumulative impact scenario considers only the impacts of G&G activities. When leases sales are conducted, the full list of oil and gas development- related IPFs will need to be assessed.

G&G survey activities are allowable in the region, though restrictions apply to some areas. BOEM has received several permit requests for G&G surveys in support of oil and gas exploration and industry has expressed interest in expanding activities on the Atlantic OCS (BOEM 2019e). The G&G and wind energy development IPFs of note that affect the acoustic environment include vessel noise, vessel traffic, noise from seismic surveys (e.g., airgun blasts), and noise from pile driving and other construction activities. The interaction of oil and gas extraction and wind energy development IPFs can be reduced by timing and location considerations. Oil and gas seismic surveys can extend over a time scale of months, whereas wind energy HRG surveys are typically on a scale of weeks. Identifying the locations and schedules of wind energy G&G and construction/installation activities and comparing them to oil and gas G&G activities could avoid overlapping impacts through appropriate scheduling to avoid cumulative impacts to the acoustic environment, particularly when considering impacts to migrating species.

### *Renewable energy development, wind*

Wind energy development is expected to continually increase in the foreseeable future along the entire Atlantic coast of the U.S. Currently, there is one operating wind energy facility, the Block Island Wind Farm BOEM currently has 15 active commercial leases and one active research lease offshore the East Coast of the U.S. The OCS-A 0508 lease for the Kitty Hawk, North Carolina Offshore Wind/Avangrid project, is in the South Atlantic AOI.

BOEM has changed its criteria for inclusion of projects in its cumulative impacts scenario as being reasonably foreseeable. BOEM now includes in its reasonably foreseeable future: all projects with COPs submitted or approved, with offtake awarded, or for which the developer has publicly announced plans of development; any additional development to fulfill the remaining, announced offshore wind solicitations; and he more likely of the remaining planned Atlantic state solicitations. Currently, these projects account for some 17GW in offshore wind energy production.

Wind energy development has the potential to produce impacts on the acoustic environment from site characterization studies (i.e., G&G surveys without airguns), site assessment data collection activities that involve installation of meteorological towers or buoys and installation and operation of turbine structures. The IPFs relevant to impacts on the acoustic environment are:

- *Site characterization surveys:* G&G survey IPFs, including noise from vessels and HRG surveys without airguns; vessel traffic.
- *Site assessment studies/installation of meteorological towers and/or buoys:* same IPFs as G&G surveys except noise from HRG surveys, onshore fabrication of structures, construction/installation impacts and anchoring, driving pilings, setting foundations for buoys; port utilization, and traffic.
- *Installation/Decommissioning of turbine structures:* all of the IPFs described for site assessment studies; noise from new cable emplacement, O&M, and decommissioning/structure removal noise and vessel traffic.

For OCS wind energy development in the South Atlantic, currently there are no PPAs or unfulfilled state demand. Therefore, no IPFs due to offshore wind in the South Atlantic are in the cumulative impacts scenario at this time. This will change when projects are planned for this area.

### *Submarine cables, transmission/telecommunication lines, pipelines*

As of December 2012, NOAA charted three submarine telecommunications cables in the South Atlantic: two near Titusville, Florida and one near Jacksonville, Florida (Figure 3-19). Two additional fiberoptic cables were recently installed in 2014 and 2015; both make landfall near Jacksonville, Florida. Two cables originate in Virginia Beach and run along the North Carolina coast and through Pamlico Sound but do not make landfall in North Carolina. Not all of these cables are necessarily utilized as the NOAA listings include both active and out of service cables.

Relatively speaking, there are few submarine cables in the South Atlantic as compared to the North and Mid-Atlantic. Submarine telecommunications cables are consistently being upgraded, enhanced, and expanded as circuit capacity is used up or current cables reach the end of their effective lifespan. Replacement and repairs of existing cables are also ongoing and are expected to continue in the foreseeable future. Thus, the expected trend for submarine cables is that activity will remain static or there may be a small increase in activity. There are six pending submarine cable installation applications with the FCC; none of which are located in the South Atlantic AOI.

IPFs of seabed cables, lines, and pipelines may interact with those of offshore wind energy development/ However, the level of vessel activity is relatively low; impacts from construction related to presence of structures are spatially localized; and temporary and have little likelihood of interacting with OCS wind energy development unless lines are located close to the offshore wind farm. This issue can be addressed during project scoping and planning.

### *Climate change*

Climate change will not directly affect the acoustic environment. Indirect impacts are conceivable, e.g., if storm severity causes increased damage to cables and lines and need additional repair, replacement, or armoring.

#### 4.3.1.2 Air Quality

**Table 4-3. Cumulative Impacts Scenario IPFs – Air Quality**

| | Dredge Material Ocean Disposal | Commercial and Recreational Fishing | Land Use /Coastal Infrastructure | Marine Minerals Extraction | Marine Transportation, Navigation, and Traffic | Military Ranges & Civilian Space Program Uses | Oil and Gas Surveys and Extraction | Renewable Energy-Wind | Submarine Cables, Lines, & Pipelines | Climate Change |
|---|---|---|---|---|---|---|---|---|---|---|
| **Offshore Wind Energy Development IPFs** | | | | | | | | | | |
| Accidental releases | ● | ● | ● | ● | ● | ● | ● | ● | ● | |
| Air emissions | ● | ● | ● | | ● | ● | ● | ● | ● | |
| Discharges | ● | ● | ● | ● | ● | ● | ● | ● | ● | |
| Energy generation, energy security | | | | | | | | ● | | ● |
| Port utilization | ● | | | | ● | | ● | ● | | ● |
| Traffic | ● | ● | ● | ● | ● | ● | ● | ● | ● | |
| **Cumulative Impact Scenario, Other IPFs** | | | | | | | | | | |
| Demolition/structure removal | | | | | | ● | ● | | | |
| Port utilization, maintenance, dredging | ● | | | | | | | | | ● |

The Clean Air Act covers emissions of air pollutants that occur up to 25 nautical miles from shore. Air pollutants in this zone must comply with the closest onshore standards. As such, analysts may prefer to focus the cumulative impacts analysis of impacts to air quality in the zone covered by Clean Air Act.

In particular, areas near shore that are proximate to large population centers may have existing air quality problems in designated non-attainment areas. Although offshore vessel traffic may have limited effects on air quality of communities onshore, vessel traffic near large ports and in or near nonattainment areas is an important consideration of impacts to air quality with regard to wind energy development in the South Atlantic AOI. Every activity that uses oceangoing vessels produces some level of air emissions, including marine transportation, fisheries, and recreational vessels. Although vessel impacts are short-term, chronic use of vessels in particular areas may contribute to adverse impacts to air quality. Because of the high volume of vessels used, commercial vessel traffic may be the most important category of vessel traffic to examine (BOEM, 2014a). Meteorological conditions and localized air quality conditions will impact the cumulative assessment of these activities (Navy 2018).

##### *Dredged material ocean disposal*

There are 8 active projects and 8 inactive/closed projects identified in the South Atlantic AOI (Table 3-10). Ocean disposal of dredge material has decreased as beneficial reuse has increased. USACE reported that about 20% to 30% of port and waterway dredged material is used for habitat creation and other beneficial uses (USACE 2012). With increased port expansion/dredging projects to handle post-Panamax vessels, BOEM expects ocean disposal activity to remain stable or increase.

The IPFs most likely to interact with OCS wind energy development and the air quality are vessel traffic and vessel operations. Vessel traffic will concentrate around shoreward routes to and from disposal sites. Wind energy projects located near these sites may need to consider potential noise interactions. However, vessel traffic associated with ocean disposal and wind energy development is a minor contributor to marine noise compared to that from marine transportation, commercial/recreational fishing, and military marine activity.

### Commercial and recreational fishing

In 2017, commercial fisheries harvested approximately 194 million pounds of fish and shellfish in the four-state region (including North Carolina, South Carolina, Georgia and Florida), with a total landed value of over $397 million (2018 dollars); over the period from 2008 to 2017, average annual landings were 190 million pounds with a value of $376 million (NOAA 2019d). The top five species by landing value in 2017 for the four-state region included for the four-state region included white shrimp, blue crab, Caribbean spiny lobster, pink shrimp, and stone crab (NOAA 2019d). Total values and pounds landed over the past ten years are shown in Figure 3-11, based on data from NOAA Fisheries. Between 2008 and 2017, the value of landings ranged from $305 million to $431 million, while landings weight ranged from 179 million pounds to 210 million pounds.

The IPFs that may interact with offshore wind energy development and contribute to air quality primarily arise from air emissions from the larger vessels used in commercial fishing. Vessel traffic from commercial and recreational fishing is a significant contributor to overall vessel traffic along the South Atlantic coast but is expected to remain stable for the foreseeable future.

### Land use and coastal infrastructure

Land use on the South Atlantic coast is diverse, encompassing many distinct environments, supporting a wide range of ecosystems, and human activities including recreation, tourism, residential, commercial, and industrial infrastructures. The impact of wind energy development on land use requirements primarily relates to the increase in port activity required to meet the demands for fabrication, construction, transportation, installation, and maintenance of wind energy structures. Connections to the power grid also may impact local land use and development.

A DOE assessment report in 2014 used the Port of Morehead City, North Carolina as a case study to estimate the capacity for offshore wind development in the South Atlantic region in the next 10-20 years. The report concluded needed improvements were minimal and if made that one port such as Morehead City would be able to satisfy the port infrastructure requirements to support offshore wind capacity development in the region. That said, DOE also anticipated multiple staging ports would be utilized to minimize transit differences. Also, given the increasing size of offshore wind turbines there may be additional improvements required.

IPFs related to land use and coastal infrastructure that may interact with wind energy related IPFs and air quality are air emissions from vessels and port operations and expansion. These impacts will be spatially limited to the area near port. The incremental increase in emissions from offshore wind development vessel activity is expected to be a minor contributor to overall port activity compared to commercial, industrial, and recreational inputs. However, baseline levels of vessel traffic and commerce at ports need to be considered for the specific port(s) used for a specific wind energy development project when assessing the significance of the incremental contribution of wind energy development to local air quality.

### Marine minerals extraction

Data on projected sand mining activity, based on current lease agreements, indicate a stable or slightly increasing trajectory through 2020. There are two active leases both of which are located offshore Brevard County, Florida and one lease request that is offshore Flagler County, Florida. There is currently one large (2.2 million cu yd) active lease located off Virginia Beach, Virginia. The lease is less than 50 km from the North Carolina border and could potentially interact with wind energy development activities in the northern areas offshore North Carolina.

States also have active minerals mining and channel dredging activities that support numerous local beach renourishment projects. However, the type and availability of data on these projects vary widely at the state and county level. The Army Corps of Engineers (USACE 2020).may have the most comprehensive source of information on these local projects at its USACE Jurisdictional Determinations and Permit Decisions website: https://permits.ops.usace.army.mil/orm-public.

Surveying for, as well as implementation of, marine minerals extraction occurs in the Atlantic. Vessel traffic associated with these activities produces air emissions in the short term (BOEM, 2014a). Vessels operate on a variety of schedules that impact operations and associated air emissions, some for multiple days, returning to shore each day or staying out at sea (BOEM, 2014a). Vessel surveys for prospecting of marine minerals are often over smaller areas relative to oil and gas surveys of 300 to 1000 hectares, last one to five days, and are conducted by smaller vessels of 65 to 98 ft (BOEM, 2014a). Geotechnical testing surveys similarly use smaller vessels and last three days or less (BOEM, 2014a).

### *Marine transportation*

Marine transportation in the South Atlantic region is diverse. It includes cargo; tug/barge; liquid tanker; dredging; underwater/diving operations; military operations, training, and testing; scientific research; search-and-rescue vessels, and recreational traffic. Commercial and recreational fishing are discussed in detail as a separate element in the cumulative impact scenario on Chapter 3.7.

Vessel call volume remained relatively steady from 2006 to 2015, with no discernible trend, as illustrated in Table 3-17 for selected ports and terminals in the South Atlantic and in Figure 3-9 for the five busiest South Atlantic ports. However, USACE has identified the Southeast coast ports as top candidates for economically justified port expansion projects to improve ports capable of handling post-Panamax vessels. Port expansion would involve dredging deeper channels and increasing the size and capabilities of port equipment, e.g., larger winches and cranes and associated power upgrades. If this improvement occurs commercial ship traffic in the Southeast may see a future increase.

Marine transportation is an ongoing, regular activity that occurs across the coast and in the long term this traffic is expected to increase (BOEM, 2012a). Marine transportation activities are sources of chronic (long-term) air pollutant emissions throughout many offshore areas (BOEM, 2014a). Closer to shore, traffic is concentrated in key shipping channels and port areas (BOEM, 2014a). Vessels travelling in the North Atlantic within 200 nm are required to comply with the ECA requirements for low sulfur oxide and nitrous oxide emissions. In response, operators can elect to change fuel types as they approach the 200 nm boundary, which could be cause for potential operational or navigational concerns if near offshore structures.

### *Military use, military range complexes, civilian space programs*

The Navy represents a significant extensive military use of the coastal and offshore environment; NASA leads the civilian space program’s use offshore Virginia, near the northern border of the South Atlantic AOI, and in the South Atlantic AOI offshore Cape Canaveral, Florida. Military use of coastal and offshore areas is not restricted to the Navy; the Coast Guard, Marines, Air Force, and Army all utilize these areas for operations, training, and testing.

There is always substantial uncertainty in predicting the levels of military use of the range complexes in the future as world events unfold. In the near term, the level of military activity will likely remain relatively stable in the AOI, although fiscal trends are placing downward pressure on these activities. Civilian space program uses in the region may increase above the present level given the recent expansion of commercial interest in space travel and privatization of previously government responsibilities.

Military aircraft and vehicles emit a variety of air pollutants and greenhouse gases during operations. In addition, air emissions are emitted from munitions training and testing. These emissions are generally localized and temporary (Navy 2018). Repetitive and routine training could result in higher air emissions (Navy 2018). Cumulative impacts would be expected in and adjacent to areas where military training or testing activity occurs (Navy 2018).

### *Oil and gas surveys and extraction*

The Atlantic has seen minimal oil and gas development interest and activity from the 1970s through the present: between 1979 and 1984 eight exploratory wells were drilled with no economically viable discoveries. The current five-year OCS oil and gas lease sale plan has no lease sales scheduled through 2022. Any projections for future leasing in the Atlantic would be speculative. Therefore, the cumulative impact scenario considers only the impacts of G&G activities. When leases sales are conducted, the full list of oil and gas development- related IPFs will need to be assessed.

G&G survey activities are allowable in the region, though restrictions apply to some areas. BOEM has received several permit requests for G&G surveys in support of oil and gas exploration and industry has expressed interest in expanding activities on the Atlantic OCS (BOEM 2019e). G&G survey vessels for oil and gas extraction create air pollutant and greenhouse gas emissions (MMS 2007). Survey vessels often operate for multiple days and may spend multiple days at sea. Accidental releases of fuel or oil spills could also impact air quality as fugitive air emissions and air toxins are released from chemicals (BOEM 2016a). Ships conducting seismic exploration surveys can take days, weeks or months depending on the size of the survey area.

### *Renewable energy development, wind*

Wind energy development is expected to continually increase in the foreseeable future along the entire Atlantic coast of the U.S. Currently, there is one operating wind energy facility, the Block Island Wind Farm BOEM currently has 15 active commercial leases and one active research lease offshore the East Coast of the U.S. The OCS-A 0508 lease for the Kitty Hawk, North Carolina Offshore Wind/Avangrid project, is in the South Atlantic AOI.

BOEM has changed its criteria for inclusion of projects in its cumulative impacts scenario as being reasonably foreseeable., BOEM now includes in its reasonably foreseeable future: all projects with COPs submitted or approved, with offtake awarded, or for which the developer has publicly announced plans of development; any additional development to fulfill the remaining, announced offshore wind solicitations; and he more likely of the remaining planned Atlantic state solicitations. Currently, these projects account for some 17GW in offshore wind energy production.

Wind energy development has the potential to produce impacts from site characterization studies (i.e., G&G surveys without airguns), site assessment data collection activities that involve installation of meteorological towers or buoys and installation and operation of turbine structures. The IPFs relevant to impacts on air quality are:

- *Site characterization surveys:* G&G survey IPFs, air emissions from vessels.
- *Site assessment studies/installation of meteorological towers and/or buoys:* same IPFs as G&G surveys except air emissions, air emissions from onshore fabrication of structures, construction/installation impacts and anchoring, driving pilings, setting foundations for buoys; port utilization, and vessel traffic.
- *Installation/Decommissioning of turbine structures:* all of the IPFs described for site assessment studies; port utilization and expansion, presence of structures, new cable emplacement; O&M; and decommissioning/structure removal noise and vessel traffic.

For OCS wind energy development in the South Atlantic, BOEM currently has determined there are no reasonably foreseeable offshore wind development. Consequently, OCS wind energy development in the South Atlantic is not projected to impact any potentially affected resource nor interact with any actions or activities included in the cumulative impacts scenario.

### *Submarine cables, transmission/telecommunication lines, pipelines*

As of December 2012, NOAA charted 3 submarine telecommunications cables in the South Atlantic: two near Titusville, Florida and one near Jacksonville, Florida (Figure 3-19). Two additional fiberoptic cables were recently installed in 2014 and 2015; both make landfall near Jacksonville, Florida. Two cables originate in Virginia Beach and run along the North Carolina coast and through Pamlico Sound but do not make landfall in North Carolina. Not all of these cables are necessarily utilized as the NOAA listings include both active and out of service cables.

Relatively speaking, there are few submarine cables in the South Atlantic as compared to the North and Mid-Atlantic. Submarine telecommunications cables are consistently being upgraded, enhanced, and expanded as circuit capacity is used up or current cables reach the end of their effective lifespan. Replacement and repair of existing cables are also ongoing and are expected to continue in the foreseeable future. Thus, the expected trend for submarine cables is that activity will remain static or there may be a small increase in activity. There are six pending submarine cable installation applications with the FCC; none are located in the South Atlantic.

Submarine cables, lines, and pipeline IPFs that may overlap with those of wind energy development include: accidental releases, of fuel, fluids, trash, and debris; air emissions from vessels; installation of new subsea cables; vessel discharges; electromagnetic fields; vessel and construction noise; presence of structure impacts such as offshore and onshore new cable infrastructure; onshore space use conflicts; and vessel traffic and vessel strikes.

The IPFs of seabed cables, lines, and pipelines that interact with wind energy IPFs and air quality are primarily related to vessel activity and powering the trenching and dredging operations. These impacts will be temporary and localized and have little likelihood on interacting with the OCS wind energy development.

### *Climate change*

Climate change will not directly affect the acoustic environment. Indirect impacts are conceivable, e.g., changes in noise levels from commercial fishing operations moving to different areas or occurring at different times as a result of fish stock migrations to or from current distributions.

#### *4.3.1.3 Mineral Resources*

**Table 4-4. Cumulative Impacts Scenario IPFs – Mineral Resources**

| | Dredge Material Ocean Disposal | Commercial and Recreational Fishing | Land Use /Coastal Infrastructure | Marine Minerals Extraction | Marine Transportation, Navigation, and Traffic | Military Ranges & Civilian Space Program Uses | Oil and Gas Surveys and Extraction | Renewable Energy-Wind | Submarine Cables, Lines, & Pipelines | Climate Change |
|---|---|---|---|---|---|---|---|---|---|---|
| **Offshore Wind Energy Development IPFs** | | | | | | | | | | |
| Anchoring | | | | | | ● | ● | ● | | |
| Discharges | ● | ● | ● | ● | ● | ● | ● | ● | ● | |
| New cable emplacement/maintenance | | | | | | | | ● | ● | ● |
| Noise | ● | ● | ● | ● | ● | ● | ● | ● | ● | |
| Port utilization | ● | | | | ● | | ● | ● | | ● |
| Traffic | ● | ● | ● | ● | ● | ● | ● | ● | ● | |
| **Cumulative Impact Scenario, Other IPFs** | | | | | | | | | | |
| Beach restoration | ● | | | ● | | | | | | ● |
| Guidance/fiber optic wires, entanglement | | | | | | ● | | | | |
| Gear utilization | | ● | | ● | | ● | | | | ● |
| Ocean acidification | | | | | | | | | | ● |
| Port utilization, maintenance, dredging | ● | | | | | | | | | ● |
| Pipeline trenching | | | | | | | ● | | | |
| Resource exploitation | | ● | | | | | | | | ● |
| Sediment deposition and burial | ● | | | | | | | | | ● |
| Seabed profile alterations | | | | ● | | | | | | ● |
| Warming and sea-level rise | | | | | | | | | | ● |

OCS sand, gravel, and shell resources are used for shore protection and for beach and coastal restoration. Although using offshore sand for beach replenishment along the Atlantic coast has occurred for decades, recent storm events have highlighted the national importance of coastal remediation and resilience in the sustainability of coastal ecosystems, tourism, coastal development, marine transportation, fisheries, energy development, and both defense and strategic infrastructure.

States also have active minerals mining and channel dredging activities that support numerous local beach renourishment projects. However, the type and availability of data on these projects vary widely at the state and county level. Evaluating the potential interactions with offshore wind energy development and such local projects appears to require real-time effort at state- and county-level offices. The Army Corps of Engineers (USACE 2020).may have the most comprehensive source of information on these local projects at its USACE Jurisdictional Determinations and Permit Decisions website: https://permits.ops.usace.army.mil/orm-public.

Compared to other resources considered in this document, minerals mining has three important distinctions. One is the value of minerals resources is in their extraction; the major impact producing factor affecting minerals resources is their exploitation. Another distinction is that minerals resources are not damaged by many IPFs that adversely affect other resources. For example, air emissions, bycatch, discharges, ingestion, or noise. The third distinction is that space-use conflicts seem to be the primary way these resources could be affected by other OCS actions or activities. Many other IPFs, such as anchoring, new cable/transmission line emplacement, pipeline trenching, or presence of structures are bottom-directed. However, because borrow sites go through a designation and approval process and are at fixed locations, potential impacts can be avoided or otherwise managed through the planning process for minerals mining and other OCS actions or activities with these types of associated IPFs. Vessel traffic of other OCS actions and activities remains as an unmanaged potential IPF

### Dredged material ocean disposal

There are 8 active projects and 8 inactive/closed projects identified in the South Atlantic AOI (Table 3-10). Ocean disposal of dredge material has decreased as beneficial reuse has increased. USACE reported that about 20% to 30% of port and waterway dredged material is used for habitat creation and other beneficial uses (USACE 2012). With increased port expansion/dredging projects to handle post-Panamax vessels, BOEM expects ocean disposal activity to remain stable or increase.

The IPFs associated with dredge material ocean disposal that are also associated with offshore wind development and may impact marine minerals resources are primarily related to discharges from vessel traffic and operations and benthic operations and releases. Vessel traffic will concentrate around shoreward routes to and from disposal sites. However, vessel traffic associated with ocean disposal and wind energy development is a minor contributor to marine noise compared to that from marine transportation, commercial/recreational fishing, and military marine activity. In addition, there is little likelihood that ocean disposal will impact marine minerals resources because both disposal sites and borrow sites are designated respectively by EPA and BOEM. EPA also regulates the quality of dredge spoils and must concur with USACE disposal permits.

Because ocean disposal activity off the Atlantic coast appears to be static or somewhat increasing, revisiting expected ocean disposal activity in the cumulative impact scenario would be prudent in case the current observed trend in beach nourishment or restoration becomes skewed by some transient or unforeseen factor.

### Commercial and recreational fishing

In 2017, commercial fisheries harvested approximately 194 million pounds of fish and shellfish in the four-state region (including North Carolina, South Carolina, Georgia and Florida), with a total landed value of over $397 million (2018 dollars); over the period from 2008 to 2017, average annual landings were 190 million pounds with a value of $376 million (NOAA 2019d). The top five species by landing value in 2017 for the four-state region included for the four-state region included white shrimp, blue crab, Caribbean spiny lobster, pink shrimp, and stone crab (NOAA 2019d). Total values and pounds landed over the past ten years are shown in Figure 3-11, based on data from NOAA Fisheries. Between 2008 and 2017, the value of landings ranged from $305 million to $431 million, while landings weight ranged from 179 million pounds to 210 million pounds.

Commercial and recreational fishing IPFs that coincide with those of offshore wind development and impact marine minerals resources are vessel traffic, and traffic. The IPFs of commercial and recreational fishing are primarily related to larger vessels used in commercial fishing. The IPFs that may interact with offshore wind energy development and contribute to minerals mining impacts are vessel traffic and port utilization. Vessel traffic from commercial and recreational fishing is a significant contributor to overall vessel traffic along the South Atlantic coast. Vessel traffic is expected to remain stable for the foreseeable future. Traffic is limited primarily by the relatively low amount of OCS wind energy vessel traffic and mining-related vessel traffic as well as the designation use of specified borrow sites.

### Land use and coastal infrastructure

Land use on the South Atlantic coast is diverse, encompassing many distinct environments, supporting a wide range of ecosystems, and human activities including recreation, tourism, residential, commercial, and industrial infrastructures. The impact of wind energy development on land use requirements primarily relates to the increase in port activity required to meet the demands for fabrication, construction, transportation, installation, and maintenance of wind energy structures. Connections to the power grid also may impact local land use and development.

The impact of wind energy development on land use requirements primarily relate to the increase in port activity required to meet the demands for fabrication, construction, transportation and installation of wind energy structures. The incremental increase from offshore wind development will be a minor contributor to port activity or port expansion required to meet commercial, industrial, and recreational demand. DOE found that the current bearing capacity of existing ports is considered suitable for wind turbines, requiring no port modifications for supporting offshore wind energy development although given the increasing size of offshore wind turbines additional improvements may be required. However, DOE also anticipated multiple staging ports could be utilized to minimize transit differences.

IPFs related to land use and coastal infrastructure and offshore wind development that may interact with marine minerals mining are vessel traffic and port utilization. This impact will be spatially limited to the area near ports; the increase in traffic from offshore wind development vessel activity is expected to be a minor contributor to overall port activity compared to commercial, industrial, and recreational inputs. Indirectly, however, an IPF related to land use and coastal infrastructure and offshore wind energy that is relevant to marine minerals resources is coastal development that increases the need for beach and coastal habitat restoration and thus the demand for sand and gravel.

Baseline levels of vessel traffic and commerce, especially if smaller ports are selected, need to be considered for the specific port(s) used for a specific wind energy development project when assessing the potential significance of the incremental contribution of wind energy development to the local acoustic environment.

### *Marine transportation*

Marine transportation in the South Atlantic region is diverse. It includes cargo; tug/barge; liquid tanker; dredging; underwater/diving operations; military operations, training, and testing; scientific research; search-and-rescue vessels, and recreational traffic. Commercial and recreational fishing are discussed in detail as a separate element in the cumulative impact scenario on Chapter 3.7.

Vessel call volume remained relatively steady from 2006 to 2015, with no discernible trend, as illustrated in Table 3-17 for selected ports and terminals in the South Atlantic and in Figure 3-9 for the five busiest South Atlantic ports. However, USACE has identified the Southeast coast ports as top candidates for economically justified port expansion projects to improve ports capable of handling post-Panamax vessels. Port expansion would involve dredging deeper channels and increasing the size and capabilities of port equipment, e.g., larger winches and cranes and associated power upgrades. If this improvement occurs commercial ship traffic in the Southeast may see a future increase.

However, although fewer calls suggest a potential lessening of the maritime shipping industry reduce noise generation from marine transportation, these larger ships may also create a greater acoustic profile that negates any decrease from less traffic.

Marine transportation IPFs that potentially interact with OCS wind energy development include accidental releases, air emissions, discharges, noise, port utilization, presence of structures/offshore space use conflicts, vessel traffic, and vessel noise. IPFs of marine transportation that may overlap with wind energy IPFs and are relevant to marine minerals resources port utilization and channel maintenance dredging and vessel traffic. These IPFs will have little or no impact on marine minerals resources. Wind energy vessel activity is a small portion of overall marine traffic; wind related G&G surveys have limited durations that reduces their potential interaction with minerals mining. The impact of wind energy development and marine transportation on designated borrow sites can be minimized during site designation by BOEM.

Vessel activity from wind energy leases near marine transportation routes may interact to increase overall noise in the vicinity of the WTGs but also are a small portion of overall vessel traffic. Wind energy development could potentially impact shipping fairways, traffic lanes, and anchorage areas. This concern, however, should be addressed in the scoping and public comment phases of the offshore wind energy leasing process.

### *Military use, military range complexes, civilian space programs*

The Navy represents a significant extensive military use of the coastal and offshore environment; NASA leads the civilian space program's use offshore Virginia (near the northern border of the South Atlantic AOI), and in the South Atlantic AOI offshore Cape Canaveral, Florida. Military use of coastal and offshore areas is not restricted to the Navy; the Coast Guard, Marines, Air Force, and Army all utilize these areas for operations, training, and testing.

There is always substantial uncertainty in predicting the levels of military use of the range complexes in the future as world events unfold. In the near term, the level of military activity will likely remain relatively stable in the AOI, although fiscal trends are placing downward pressure on these activities. Civilian space program uses in the region may increase above the present level given the recent expansion of commercial interest in space travel and privatization of previously government responsibilities.

Military and civilian space uses along the Atlantic coast from North Carolina to Florida have many IPFs that could interact with offshore wind energy development, including accidental releases, anchoring, discharges, and traffic. The IPF of military and civilian space uses that is most likely to potentially interact with OCS wind energy development and relevant to minerals mining is vessel traffic. Although there is great overlap between military use areas, transits lanes, and marine minerals mining the likelihood of conflicts is low because of BOEM authority to designate borrow sites with input from DOD and BOEM's coordination and evacuation lease stipulations with the military and NASA that remove civilian activities from testing and training areas in active use.

### *Oil and gas surveys and extraction*

The Atlantic has seen minimal oil and gas development interest and activity from the 1970s through the present. The current five-year OCS oil and gas lease sale plan has no lease sales scheduled through 2022. Any projections for future leasing in the Atlantic would be speculative. Therefore, the cumulative impact scenario considers only the impacts of G&G activities. When leases sales are conducted, the full list of oil and gas development- related IPFs will need to be assessed.

G&G survey activities are allowable in the region, though restrictions apply to some areas. BOEM has received several permit requests for G&G surveys in support of oil and gas exploration and industry has expressed interest in expanding activities on the Atlantic OCS (BOEM 2019e).

The interaction of oil and gas extraction and wind energy development IPFs that could impact marine minerals mining is G&G survey vessel traffic.  G&G surveys. Conflicts among oil and gas, wind energy, and minerals mining can be mitigated by timing and location considerations. Oil and gas seismic surveys can extend over a time scale of months, whereas wind energy HRG surveys are typically on a scale of weeks. Identifying the locations and schedules of wind energy G&G and construction/installation activities and comparing them to oil and gas G&G activities also could avoid overlapping impacts through appropriate scheduling to avoid cumulative impacts.

### *Renewable energy development, wind*

Currently, there is one operating wind energy facility, the Block Island Wind Farm BOEM currently has 15 active commercial leases and one active research lease offshore the East Coast of the U.S. The OCS-A 0508 lease for the Kitty Hawk, North Carolina Offshore Wind/Avangrid project, is in the South Atlantic AOI.

BOEM has changed its criteria for inclusion of projects in its cumulative impacts scenario as being reasonably foreseeable. BOEM now includes in its reasonably foreseeable future: all projects with COPs submitted or approved, with offtake awarded, or for which the developer has publicly announced plans of development; any additional development to fulfill the remaining, announced offshore wind solicitations;

and he more likely of the remaining planned Atlantic state solicitations. Currently, these projects account for some 17GW in offshore wind energy production.

Wind energy development has the potential to produce impacts from site characterization studies (i.e., G&G surveys without airguns), site assessment data collection activities that involve installation of meteorological towers or buoys, and installation and operation of turbine structures. The IPFs relevant to impacts on the minerals resources are:

*Site characterization surveys*

- vessel traffic.

*Site assessment studies/installation of meteorological towers and/or buoy*

- same IPFs as G&G surveys, plus
- construction/installation impacts and anchoring
- driving pilings, and setting foundations for buoys
- port utilization and traffic.

*Installation/Decommissioning of turbine structures*

- all of the IPFs described for site assessment studies, plus
- port expansion
- new cable emplacement
- decommissioning/structure removal noise and vessel traffic.

For OCS wind energy development in the South Atlantic, BOEM currently has determined there are no reasonably foreseeable offshore wind development. Consequently, OCS wind energy development in the South Atlantic is not projected to impact any potentially affected resource nor interact with any actions or activities included in the cumulative impacts scenario.

### *Submarine cables, transmission/telecommunication lines, pipelines*

As of December 2012, NOAA charted three submarine telecommunications cables in the South Atlantic: two near Titusville, Florida and one near Jacksonville, Florida (Figure 3-19). Two additional fiberoptic cables were recently installed in 2014 and 2015; both make landfall near Jacksonville, Florida. Two cables originate in Virginia Beach and run along the North Carolina coast and through Pamlico Sound but do not make landfall in North Carolina. Not all of these cables are necessarily utilized as the NOAA listings include both active and out of service cables.

Relatively speaking, there are few submarine cables in the South Atlantic as compared to the North and Mid-Atlantic. Submarine telecommunications cables are consistently being upgraded, enhanced, and expanded as circuit capacity is used up or current cables reach the end of their effective lifespan. Replacement and repair of existing cables are also ongoing and are expected to continue in the foreseeable future. Thus, the expected trend for submarine cables is that activity will remain static or there may be a small increase in activity. There are six pending submarine cable installation applications with the FCC; none are located in the South Atlantic.

Submarine cables, lines, and pipeline IPFs that may overlap with those of wind energy development include accidental releases, air emissions, installation of new subsea cables, discharges, electromagnetic fields, noise; presence of structure, new cable infrastructure, onshore space use conflicts, and traffic.

The IPFs that overlap between submarine cables, lines, and pipeline and offshore wind energy that may impact marine minerals resources are vessel traffic and benthic-directed operations. These impacts will generally be short-term and localized and have little likelihood of significant impacts. Because minerals mining occurs at well-designated borrow sites by BOEM, future seabed cable, line, and pipeline activity will avoid these sites and any impacts on marine minerals mining. The IPF of installation and maintenance of new subsea cables lines, or pipelines could overlap with the wind energy emplacement of transmission lines could be problematic. However, such conflicts should be resolved during project planning, which is also when any issue with marine minerals extraction would be resolved

### *Climate change*

Climate change disrupts geophysical and biological resources globally (see Section 3.8). Climate change may directly or indirectly alter the impacts of IPFs that affect marine minerals mining by increasing the need for beach and coastal restoration projects due to increase storm intensity and frequency. To the degree wind energy development offsets the use of fossil fuel used to generate power, it will reduce carbon emissions and further efforts to reduce global warming.

#### 4.3.1.4 Water Quality

**Table 4-5. Cumulative Impacts Scenario IPFs – Water Quality**

| | Dredge Material Ocean Disposal | Commercial and Recreational Fishing | Land Use /Coastal Infrastructure | Marine Minerals Extraction | Marine Transportation, Navigation, and Traffic | Military Ranges & Civilian Space Program Uses | Oil and Gas Surveys and Extraction | Renewable Energy-Wind | Submarine Cables, Lines, & Pipelines | Climate Change |
|---|---|---|---|---|---|---|---|---|---|---|
| **Offshore Wind Energy Development IPFs** | | | | | | | | | | |
| Accidental releases | ● | ● | | ● | ● | ● | ● | ● | ● | |
| Anchoring | | | | | | ● | ● | ● | | |
| Discharges | ● | ● | ● | ● | ● | ● | ● | ● | ● | |
| New cable emplacement/maintenance | | | | | | | | ● | ● | ● |
| Port utilization | ● | | | | ● | | ● | ● | | ● |
| Presence of structures | | | ● | | | ● | ● | ● | ● | ● |
| Traffic | ● | ● | ● | ● | ● | ● | ● | ● | ● | |
| **Cumulative Impact Scenario, Other IPFs** | | | | | | | | | | |
| Demolition/structure removal | | | | | | ● | ● | | | |
| Gear utilization | | ● | | ● | | ● | | | | ● |
| Land disturbance | | | ● | | | | ● | | | ● |
| Port utilization, maintenance, dredging | ● | | | | | | | | | ● |
| Pipeline trenching | | | | | | | ● | | | |
| Sediment deposition and burial | ● | | | | | | | | | ● |
| Seabed profile alterations | | | | ● | | | | | | ● |
| Warming and sea-level rise | | | | | | | | | | ● |

The Clean Water Act (CWA) is the principle legislation that regulates water quality in U.S. waters. EPA administers the CWA and regulates the discharge of pollutants form point and nonpoint sources through a number of regulations, of which permits issued through the NPDES are fundamental. NPDES permits use technology-based, water quality-based, whole effluent toxicity, and receiving water- based pollution controls. The NPDES permit system covers discharges from oil and gas extraction units and production facilities, ships >79 feet and ballast water discharges from all vessels, including commercial fishing vessels. EPA sets the criteria for designating ocean disposal sites, the quality of the material authorized for ocean disposal, and approves all ocean disposal permits issued by USACE. EPA regulates industrial and municipal point source discharges, municipal ocean outfalls, and non-point source pollution to water bodies of the US.

##### *Dredged material ocean disposal*

The contribution of ocean disposal to the water quality would be minimized because EPA has established criteria that dredge spoils are required to meet for spoils to be authorized for ocean disposal. There are 8 active projects and 8 inactive/closed projects identified in the South Atlantic AOI (Table 3-10). Ocean disposal of dredge material has decreased as beneficial reuse has increased. USACE reported that about 20% to 30% of port and waterway dredged material is used for habitat creation and other beneficial uses. With increased port expansion/dredging projects to handle post-Panamax vessels, BOEM expects ocean disposal activity to remain stable or increase.

The IPFs associated with dredge material ocean disposal that are also associated with offshore wind development and could affect water quality are primarily vessel related: accidental releases, discharges; and vessel traffic. Discharges from both activities are covered under EPA and USACE permit programs that authorize discharges that meet criteria to avoid water quality impacts. Additionally, vessel traffic associated with ocean disposal and wind energy development is a minor contributor to changes in water quality compared to that from marine transportation, commercial/recreational fishing, and military marine activity.

### *Commercial and recreational fishing*

In 2017, commercial fisheries harvested approximately 194 million pounds of fish and shellfish in the four-state region (including North Carolina, South Carolina, Georgia and Florida), with a total landed value of over $397 million (2018 dollars); over the period from 2008 to 2017, average annual landings were 190 million pounds with a value of $376 million (NOAA 2019d). The top five species by landing value in 2017 for the four-state region included for the four-state region included white shrimp, blue crab, Caribbean spiny lobster, pink shrimp, and stone crab (NOAA 2019d). Total values and pounds landed over the past ten years are shown in Figure 3-11, based on data from NOAA Fisheries. Between 2008 and 2017, the value of landings ranged from $305 million to $431 million, while landings weight ranged from 179 million pounds to 210 million pounds.

Commercial and recreational fishing IPFs that coincide with those of offshore wind development and affect water quality include accidental releases, discharges, port utilization, and traffic; they are primarily related to larger vessels used in commercial fishing. Discharges from vessels are covered under EPA (the vessel general permit) and USCG ballast water regulations that impose discharge criteria to avoid water quality impacts.

Vessel traffic associated with wind energy development is a minor contributor to changes in water quality compared to that from marine transportation, commercial/recreational fishing, and military marine activity. Vessel traffic from commercial and recreational fishing is a significant contributor to overall vessel traffic. Accidental releases are low probability events, as are releases of contaminants from ship collisions and are expected to have little impact on water quality.

### *Land use and coastal infrastructure*

Land use on the South Atlantic coast is diverse, encompassing many distinct environments, supporting a wide range of ecosystems, and human activities including recreation, tourism, residential, commercial, and industrial infrastructures. The impact of wind energy development on land use requirements primarily relates to the increase in port activity required to meet the demands for fabrication, construction, transportation, installation, and maintenance of wind energy structures. Connections to the power grid also may impact local land use and development.

A DOE assessment report in 2014 used the Port of Morehead City, North Carolina as a case study to estimate the capacity for offshore wind development in the South Atlantic region in the next 10-20 years. The report concluded needed improvements were minimal and if made that one port such as Morehead City would be able to satisfy the port infrastructure requirements to support offshore wind capacity development in the region. That said, DOE also anticipated multiple staging ports would be utilized to minimize transit differences. Also, given the increasing size of offshore wind turbines there may be additional improvements required.

IPFs related to land use and coastal infrastructure and offshore wind development include accidental release, discharges, port utilization, and vessel traffic. Point source discharges are controlled through NPDES permitting requirements; nonpoint sources discharges are controlled by EPA through Best Management Practices. These impacts will be spatially limited to the area near port. Coastal development and increased OCS wind energy activity may result in water quality impacts. Baseline levels of land use impacts and vessel traffic at ports need to be considered for the specific port(s) used for specific wind energy development projects when assessing the significance of the incremental contribution of wind energy development to water quality.

### *Marine minerals extraction*

Data on projected sand mining activity, based on current lease agreements, indicate a stable or slightly increasing trajectory through 2020. There are two active leases both of which are located offshore Brevard County, Florida and one lease request that is offshore Flagler County, Florida. There is currently one large (2.2 million cu yd) active lease located off Virginia Beach, Virginia. The lease is less than 50 km from the North Carolina border and could potentially interact with wind energy development activities in the northern areas offshore North Carolina.

States also have active minerals mining and channel dredging activities that support numerous local beach renourishment projects. However, the type and availability of data on these projects vary widely at the state and county level. Evaluating the potential interactions with offshore wind energy development and such local projects appears to require real-time effort at state- and county-level offices. The Army Corps of Engineers (USACE 2020).may have the most comprehensive source of information on these local projects at its USACE Jurisdictional Determinations and Permit Decisions website: https://permits.ops.usace.army.mil/orm-public.

Sand mining IPFs that have the potential to interact with wind energy IPFs and water quality are accidental releases and discharges, but only under limited spatial and temporal conditions. Project-level dredging activities and wind energy construction and installation activities are typically relatively short-term efforts–one or two years, with a maximum duration of three years for USACE permits–and water quality impacts arising from seafloor disturbances from either activity are relatively localized in their spatial extent. There is the possibility of dredging for a series of beach restoration projects resulting in longer-term impacts. Ship traffic associated with marine mining and OCS wind development are small compared to overall maritime traffic and any water quality impacts from these operations commensurately small.

### *Marine transportation*

Marine transportation in the South Atlantic region is diverse, including cargo; tug/barge; liquid tanker; dredging; underwater/diving operations; military operations, training, and testing; scientific research; search-and-rescue vessels, and recreational traffic. Commercial and recreational fishing are discussed in detail as a separate element in the cumulative impact scenario on Chapter 3.7.

Vessel call volume remained relatively steady from 2006 to 2015, with no discernible trend, as illustrated in Table 3-17 for selected ports and terminals in the South Atlantic and in Figure 3-9 for the five busiest South Atlantic ports. However, USACE has identified the Southeast coast ports as top candidates for economically justified port expansion projects to improve ports capable of handling post-Panamax vessels. Port expansion would involve dredging deeper channels and increasing the size and capabilities of port equipment, e.g., larger winches and cranes and associated power upgrades. If this improvement occurs commercial ship traffic in the Southeast may see a future increase. However, although fewer calls suggest a potential lessening of the maritime shipping industry reduce noise generation from marine transportation, these larger ships may also create a greater acoustic profile that negates any decrease from less traffic.

The IPFs of marine transportation relevant to water quality that may overlap with those of offshore wind energy will likely be local impacts at ports and terminals and include accidental releases; discharges; and port channel maintenance dredging. Operational discharges from ships are regulated under multiple statutes including MARPOL, EPA statutes and permits, and USCG regulations that are all intended to regulate effluent quality and preserve water quality. Accidental releases are low probability events, as are releases of contaminants from ship collisions. Although marine transportation is a major use of the coastal waters of the U.S., wind energy vessel activity is a very small portion of overall marine traffic and water quality impacts are expected to be minimal.

### *Military use, military range complexes, civilian space programs*

The Navy represents a significant extensive military use of the coastal and offshore environment; NASA leads the civilian space program's use offshore Virginia, near the northern border of the South Atlantic AOI, and in the South Atlantic AOI offshore Cape Canaveral, Florida. Military use of coastal and offshore areas is not restricted to the Navy; the Coast Guard, Marines, Air Force, and Army all utilize these areas for operations, training, and testing. The Navy released its Final EIS on its Atlantic fleet training and testing in September 2018 (Navy 2018).

There is always substantial uncertainty in predicting the levels of military use of the range complexes in the future as world events unfold. In the near term, the level of military activity will likely remain relatively stable in the AOI, although fiscal trends may place downward pressure on these activities. Civilian space program uses in the region may increase above the present level given the recent expansion of commercial interest in space travel and privatization of previously government responsibilities.

Military and civilian space uses along the Atlantic coast from North Carolina to Florida have many IPFs that could interact with offshore wind energy development and affect water quality. The IPFs that are most likely to affect water quality include accidental releases, discharges, and port channel maintenance dredging.

The Navy released its Final EIS on its Atlantic fleet training and testing in September 2018 and concluded the physical and chemical changes resulting from its testing and training activities, as measured by the concentrations of contaminants or other anthropogenic compounds, may be detectable but would be below applicable regulatory standards for determining effects on biological resources (Navy 2018). Wind energy vessel activity is a very small portion of overall marine traffic and expected to have little or no effect water quality.

Operational discharges from ships are regulated under multiple statutes including MARPOL, EPA statutes and permits, and USCG regulations that are all intended to regulate effluent quality and preserve water quality. Accidental releases are low probability events, as are releases of contaminants from ship collisions. Although military operations are a major use of the coastal waters of the U.S., significant water quality impacts are expected to be minimal.

### *Oil and gas surveys and extraction*

The Atlantic has seen minimal oil and gas development interest and activity from the 1970s through the present. The current five-year OCS oil and gas lease sale plan has no lease sales scheduled through 2022. Any projections for future leasing in the Atlantic would be speculative. Therefore, the cumulative impact scenario considers only the impacts of G&G activities. When leases sales are conducted, the full list of oil and gas development- related IPFs will need to be assessed.

G&G survey activities are allowable in the region, though restrictions apply to some areas. BOEM has received several permit requests for G&G surveys in support of oil and gas exploration and industry has expressed interest in expanding activities on the Atlantic OCS (BOEM 2019e). The IPFs related to oil and gas G&G activity that can interact with offshore wind development include accidental release, air emissions, discharges, light, noise, port utilization, and traffic. The G&G and wind energy development IPFs of note that could affect water quality are accidental releases and discharges.

Operational discharges from ships are regulated under multiple statutes including MARPOL, EPA permits, and USCG regulations that are all intended to regulate effluent quality and preserve water quality. Accidental releases are low probability events, as are releases of contaminants from ship collisions. Oil and gas G&G activities and wind energy vessel activity represent a small portion of overall marine traffic and are expected to have little or no effect water quality.

### *Renewable energy development, wind*

Wind energy development is expected to continually increase in the foreseeable future along the entire Atlantic coast of the U.S. Currently, there is one operating wind energy facility, the Block Island Wind Farm BOEM currently has 15 active commercial leases and one active research lease offshore the East Coast of the U.S. The OCS-A 0508 lease for the Kitty Hawk, North Carolina Offshore Wind/Avangrid project, is in the South Atlantic AOI.

BOEM has changed its criteria for inclusion of projects in its cumulative impacts scenario as being reasonably foreseeable. BOEM now includes in its reasonably foreseeable future: all projects with COPs submitted or approved, with offtake awarded, or for which the developer has publicly announced plans of development; any additional development to fulfill the remaining, announced offshore wind solicitations; and he more likely of the remaining planned Atlantic state solicitations. Currently, these projects account for some 17 GW in offshore wind energy production.

Wind energy development has the potential to produce impacts from site characterization studies (i.e., G&G surveys without airguns), site assessment data collection activities that involve installation of meteorological towers or buoys and installation and operation of turbine structures. The IPFs relevant to impacts on water quality are:

*Site characterization surveys*

- vessel operations and traffic.

*Site assessment studies/installation of meteorological towers and/or buoy*

- same IPFs as G&G surveys, plus
- construction/installation impacts
- port utilization and traffic.

*Installation/Decommissioning of turbine structures*

- same as the IPFs described for site assessment studies, plus
- port utilization and expansion
- new cable emplacement
- decommissioning/structure removal noise and vessel traffic.

For OCS wind energy development in the South Atlantic, BOEM currently has determined there are no reasonably foreseeable offshore wind development. Consequently, OCS wind energy development in the South Atlantic is not projected to impact any potentially affected resource nor interact with any actions or activities included in the cumulative impacts scenario.

### *Submarine cables, transmission/telecommunication lines, pipelines*

As of December 2012, NOAA charted three submarine telecommunications cables in the South Atlantic: two near Titusville, Florida and one near Jacksonville, Florida (Figure 3-19). Two additional fiberoptic cables were recently installed in 2014 and 2015; both make landfall near Jacksonville, Florida. Two cables originate in Virginia Beach and run along the North Carolina coast and through Pamlico Sound but do not make landfall in North Carolina. Not all of these cables are necessarily utilized as the NOAA listings include both active and out of service cables.

Relatively speaking, there are few submarine cables in the South Atlantic as compared to the North and Mid-Atlantic. Submarine telecommunications cables are consistently being upgraded, enhanced, and expanded as circuit capacity is used up or current cables reach the end of their effective lifespan. Replacement and repair of existing cables are also ongoing and are expected to continue in the foreseeable future. Thus, the expected trend for submarine cables is that activity will remain static or there may be a small increase in activity. There are six pending submarine cable installation applications with the FCC; none are in the South Atlantic.

Submarine cables, lines, and pipeline IPFs that may overlap with those of wind energy development include accidental releases, discharges, new cable emplacement/maintenance, and vessel traffic. Accidental releases are low probability events, as are releases of contaminants from ship collisions. Operational discharges from ships are regulated under multiple statutes including MARPOL, EPA statutes and permits, and USCG regulations that are all intended to regulate effluent quality and preserve water quality. The water quality impacts of IPFs of seabed cables, lines, and pipelines of note are primarily related to benthic disruptions and sediment suspension during installation, maintenance, and repair of submarine cable and lines. These impacts have little likelihood on interacting with the OCS wind energy development and even if so, the operations related to laying of submarine cables and lines and their associated impacts will be temporary and localized.

### *Climate change*

Climate change disrupts geophysical and biological resources globally. Climate change may indirectly alter the impacts of IPFs that affect water quality by increased vessel traffic associated with beach and coastal restoration projects to protect against or repair damage from storms of increased intensity and frequency and associated with potential impacts from storm-related damage to infrastructure, e.g., sewage treatment facilities, oil or gas pipelines, industrial retention ponds. To the degree wind energy development offsets the use of fossil fuel used to generate power, it will reduce carbon emissions and further efforts to reduce global warming.

### 4.3.2 Biological Resources

#### 4.3.2.1 Birds and Bats

**Table 4-6. Cumulative Impacts Scenario IPFs – Birds and Bats**

| | Dredge Material Ocean Disposal | Commercial and Recreational Fishing | Land Use /Coastal Infrastructure | Marine Minerals Extraction | Marine Transportation, Navigation, and Traffic | Military Ranges & Civilian Space Program Uses | Oil and Gas Surveys and Extraction | Renewable Energy-Wind | Submarine Cables, Lines, & Pipelines | Climate Change |
|---|---|---|---|---|---|---|---|---|---|---|
| **Offshore Wind Energy Development IPFs** | | | | | | | | | | |
| Accidental releases | ● | ● | ● | ● | ● | ● | ● | ● | ● | |
| Air emissions | ● | ● | ● | | ● | ● | ● | ● | ● | |
| Energy generation, energy security | | | | | | | | ● | | ● |
| Light | | ● | ● | | ● | ● | ● | ● | | |
| Noise | ● | ● | ● | ● | ● | ● | ● | ● | ● | |
| Port utilization | ● | | | | ● | | ● | ● | | ● |
| Presence of structures | | | ● | | | ● | ● | ● | ● | ● |
| Traffic | ● | ● | ● | ● | ● | ● | ● | ● | ● | |
| **Cumulative Impact Scenario, Other IPFs** | | | | | | | | | | |
| Beach restoration | ● | | | ● | | | | | | ● |
| Bycatch | | ● | | | | | | | | |
| Demolition/structure removal | | | | | | ● | ● | | | |
| Energy stressors/devices/lasers | | | | | | ● | | | | |
| Ingestion | | | | | | ● | | | | |
| Land disturbance | | | ● | | | | ● | | | ● |
| Ocean acidification | | | | | | | | | | ● |
| Port utilization, maintenance, dredging | ● | | | | | | | | | ● |
| Resource exploitation | | ● | | | | | | | | ● |
| Warming and sea-level rise | | | | | | | | | | ● |

The potential for avian mortality from collisions with wind energy structures is a key concern in the assessment of the potential impacts of offshore wind energy development. BOEM has sponsored several studies to address this concern,

BOEM (2016d) developed a quantitative model for fatality rates of *rufa* Red Knots from collisions with the physical structures of a model offshore wind energy facility in federal waters of Nantucket Sound, Massachusetts. The authors used a team of experts to conduct a comprehensive review of literature related to bird collision risk modeling at offshore wind energy facilities and to synthesize this information for the development of a quantitative, collision risk model. The authors included the Band model in their modeling approach to represent a subset of collision dynamics and added model elements representing the most important biological and meteorological dynamics.

The model predicted that the overall average collision fatality rate for *rufa* Red Knots, under baseline conditions, was 0.16 Red Knots per year at the facility, or equivalent to one fatality every 6.25 years. This fatality rate consisted of 0.10 predicted fatalities per fall migration season and 0.06 predicted fatalities per spring migration season. Predicted fatalities scaled linearly with population size. Collision fatality rates were largely driven by collisions with stationary structures, particularly turbine towers, which accounted for roughly 90% of all collision fatalities in most model simulations.

The effects of varying wind speed and direction, precipitation, and visibility were incorporated into the model as behavioral switches between high and low elevation migratory flight altitudes, fall migratory flight departure delay decisions, and avoidance rate parameters. Simulation results indicated that only effective headwind speed exerted a strong influence on the fatality rates.

Although eastern red bats were photographed during the day near the Virginia WEA flying at an altitude greater than 100 meters (Hatch et al. 2013), information on bat species found off the South Atlantic coast is limited. BOEM (2012a) noted information on offshore bat activity in the mid-Atlantic comes from the New Jersey Ecological Baseline Study, which included surveys out to 20 nm from shore and found no bats were during the 2009 March, April or June surveys; one detected in May; and 53 bats in August, September, and October, of which the eastern red bat was the most common bat detected. The mean distance from shore was 5.2 nm, with the farthest distance being 10.4 nm. BOEM (2015) also noted there were 12 species of bats that inhabited North Carolina) coastal counties, although only four (Rafinesque’s big-eared bat, northern yellow bat, Seminole bat, and southeastern myoti) are found near or over water (North Carolina Natural Heritage Program 2013).

BOEM (2017a) followed several tagged northern long-eared bats and did not detect offshore movements. The tracking system was found capable of detecting wide-ranging and offshore movements by other bat species that were tagged as part of their efforts. During the summer months, female northern long-eared bats on the island were active throughout the night and could easily have accessed offshore environments for foraging under calm conditions. However, the authors recorded no movements that exceeded 2 km, suggesting female northern long-eared bats are unlikely to travel into federal waters (5.6 km offshore) during this time period. The authors were not able to capture adult males northern long-eared bats on the Vineyard in 2015 or 2016. The authors also did not detect off-island movements by two northern long-eared bats tagged in September 2015 or the single northern tagged in October 2016, suggesting that some northern long-eared bats are hibernating locally on Martha’s Vineyard. Given the few northern long-eared bats tracked in the fall and the timing of those efforts, it is possible that some northern long-eared bats migrate off-island still exists.

BOEM (2016e) conducted 38 aerial surveys of seabirds south of the islands of Nantucket and Martha’s Vineyard, Massachusetts from November 2011 to January 2015 to develop a distribution of seabirds offshore Massachusetts. The study area extends some 85 km offshore to the 60 m depth contour that was designated by BOEM. BOEM (2016e) sampled approximately 23,000 linear km of transect for the study and mapped the distribution of all birds from the data acquired along standardized strip transects. Species with high abundance south of Nantucket and Martha’s Vineyard included white-winged scoters, long-tailed ducks, northern gannets, and razorbills. The authors searched for and identified locations where larger than average aggregations of seabirds occurred on a regular or repeated basis and found two. One location was near the western edge of the Nantucket Shoals; it consisted mainly of long-tailed ducks and white-winged scoters during winter and common and roseate terns during spring. A second location was in the Muskeget Channel area, consisting of scoters and eiders, loons, and terns. Overall densities of seabirds in the area were similar between years.

Brief descriptions of the interactions between birds and bats and the cumulative impact scenario actions are provided below.

### *Dredged material ocean disposal*

The IPFs associated with dredge material ocean disposal that are also associated with offshore wind development are accidental releases, air emissions, discharges; noise, and vessel traffic. The IPFs related to dredged material ocean disposal and offshore wind energy that may impact birds and bats are primarily vessel-derived stressors and include accidental releases, noise, and vessel traffic. Among these IPFs, accidental releases of fuel are generally the most serious for bird populations. Discharges and traffic IPFs are not likely to have any impact of significance on bird and bat resources. Ocean disposal activity in the South Atlantic is expected to remain stable or increase somewhat. The vessel activity contributed by ocean disposal activities and offshore wind energy to overall vessel activity in the AOI is very small in relation to other maritime shipping, commercial and recreational fishing, and military operations. Vessel traffic will concentrate around shoreward routes to and from disposal sites. Wind energy projects located near these sites may need to consider potential traffic issues.

#### *Commercial and recreational fishing*

In 2017, commercial fisheries harvested approximately 194 million pounds of fish and shellfish in the four-state region (including North Carolina, South Carolina, Georgia and Florida), with a total landed value of over $397 million (2018 dollars); over the period from 2008 to 2017, average annual landings were 190 million pounds with a value of $376 million (NOAA 2019d). The top five species by landing value in 2017 for the four-state region included for the four-state region included white shrimp, blue crab, Caribbean spiny lobster, pink shrimp, and stone crab (NOAA 2019d). Total values and pounds landed over the past ten years are shown in Figure 3-11, based on data from NOAA Fisheries. Between 2008 and 2017, the value of landings ranged from $305 million to $431 million, while landings weight ranged from 179 million pounds to 210 million pounds.

The IPFs of commercial and recreational fishing are primarily related to larger vessels used in commercial fishing. The IPFs that may interact with offshore wind energy development and contribute to the impact on birds and bats include noise related both to vessel traffic and vessel operations e.g., noise related operations, and retrieval; accidental releases; and discharges. A significant commercial fishing IPF that adversely affects birds but does not overlap with wind energy IPFs is bycatch of birds caught as a consequence of long line fishing operations.

Commercial and recreational fishing vessel traffic is substantial. Vessel traffic associated with offshore wind energy development, however, is a negligible contribution to overall marine traffic. Offshore wind energy development will not appreciably increase impacts to birds and bats to any material degree.

#### *Land use and coastal infrastructure*

Land use on the South Atlantic coast is diverse, encompassing many distinct environments, supporting a wide range of ecosystems, and human activities including recreation, tourism, residential, commercial, and industrial infrastructures. The impact of wind energy development on land use requirements primarily relates to the increase in port activity required to meet the demands for fabrication, construction, transportation, installation, and maintenance of wind energy structures. Land installations also must support the entire life cycle of offshore wind power generation, including site assessment and characterization, turbine and distribution platform installation, seabed transmission line emplacement, onshore substation construction, connections to the local power grid emergency and routine maintenance and repair.

A DOE assessment report in 2014 used the Port of Morehead City, North Carolina as a case study to estimate the capacity for offshore wind development in the South Atlantic region in the next 10-20 years. The report concluded needed improvements were minimal and if made that one port such as Morehead City would be able to satisfy the port infrastructure requirements to support offshore wind capacity development in the region. That said, DOE also anticipated multiple staging ports would be utilized to minimize transit differences. Also, given the increasing size of offshore wind turbines there may be additional improvements required.

The general trend along the coastal region is that port activity will increase modestly to support port capability adequate for increases in the general economy. This expansion will require some conversion of undeveloped land to meet port demand, which will result in habitat loss for coastal bird and bat populations. However, the incremental increase from wind development will be a minor contribution to port expansion needs compared to increased commercial, industrial, and recreational demand. The current bearing capacity of existing ports was considered suitable for wind turbines, requiring no port modifications for supporting offshore wind energy development. IPFs related to land use and coastal infrastructure and wind energy related IPFs that may impact bird and bat populations include all of the listed IPFs.

### *Marine minerals extraction*

Data on projected sand mining activity, based on current lease agreements, indicate a stable or slightly increasing trajectory through 2020. There are two active leases both of which are located offshore Brevard County, Florida and one lease request that is offshore Flagler County, Florida. There is currently one large (2.2 million cu yd) active lease located off Virginia Beach, Virginia. The lease is less than 50 km from the North Carolina border and could potentially interact with wind energy development activities in the northern areas offshore North Carolina.

States also have active minerals mining and channel dredging activities that support numerous local beach renourishment projects. However, the type and availability of data on these projects vary widely at the state and county level. The Army Corps of Engineers (USACE 2020).may have the most comprehensive source of information on these local projects at its USACE Jurisdictional Determinations and Permit Decisions website: https://permits.ops.usace.army.mil/orm-public.

Sand mining IPFs that have the potential to interact with wind energy IPFs and bird and bat populations include accidental releases, discharges noise, and traffic. Noise from vessel traffic and dredging occur under limited spatial and temporal conditions. Project-level dredging activities and wind energy construction and installation activities are typically relatively short-term efforts‒one or two years. However, dredging for a series of beach restoration projects is possible and could result in longer-term impacts. Thus, specific minerals mining projects need to be assessed if the wind energy lease is near active borrow sites. Marine minerals mining may also require G&G activities that are similar, although much less extensive, to wind energy G&G surveys and could affect bird and bat populations. The interaction of minerals mining and wind energy G&G surveys will be temporally limited and could be scheduled to be avoided. These surveys can be spatially extensive, but they are of relatively short duration and could be scheduled to avoid overlapping impacts to the acoustic environment.

The impact of marine minerals mining on bird and bat populations are not all negative. Beach and coastal nourishment and restoration projects provide shoreline protection and improved coastal habitat that will continue to support bird and bat populations.  The impact of wind energy development on dredging activity will be negligible and will not affect the beneficial impact of minerals mining on shoreline birds and bats.

### *Marine transportation*

Marine transportation in the South Atlantic region is diverse, including cargo; tug/barge; liquid tanker; dredging; underwater/diving operations; military operations, training, and testing; scientific research; and search-and-rescue vessels, and recreational traffic. Commercial and recreational fishing operations are discussed separately in detail in the cumulative impact scenario, Chapter 3.7.

Vessel call volume remained relatively steady from 2006 to 2015, with no discernible trend, as illustrated in Table 3-17 for selected ports and terminals in the South Atlantic and in Figure 3-9 for the five busiest South Atlantic ports. However, USACE has identified the Southeast coast ports as top candidates for economically justified port expansion projects to improve ports capable of handling post-Panamax vessels. Port expansion would involve dredging deeper channels and increasing the size and capabilities of port equipment, e.g., larger winches and cranes and associated power upgrades. If this improvement occurs commercial ship traffic in the Southeast may see a future increase.

IPFs that potentially interact with OCS wind energy development include accidental releases, air emissions, discharges, noise, port utilization, presence of structures/offshore space use conflicts, and traffic. The IPFs of maritime shipping that overlap with offshore wind energy and may impact bird and bat populations include accidental release, and port utilization. Offshore impacts are likely to result from accidental releases of fuel; these events are infrequent, widely dispersed spatially, and generally of short duration; these factors all limit the scale of potential impacts. Interactions of any consequence with individual bird and bats with marine transportation are more likely to occur along the coastal margins and in or near ports far from offshore wind energy projects. The patchy and relatively sparse distribution of birds offshore reduces the chance of a significant impact on bird and bat populations and will result in negligible impacts. Wind energy vessel activity is a small portion of overall marine traffic and its incremental increase results in little or no additional impact.

### *Military use, military range complexes, civilian space programs*

The Navy represents a significant extensive military use of the coastal and offshore environment; NASA leads the civilian space program's use offshore Virginia, near the northern border of the South Atlantic AOI, and in the South Atlantic AOI offshore Cape Canaveral, Florida. Military use of coastal and offshore areas is not restricted to the Navy; the Coast Guard, Marines, Air Force, and Army all utilize these areas for operations, training, and testing.

The Navy released its Final EIS on its Atlantic fleet training and testing in September 2018. The Navy determined training and testing activities have the potential to expose maritime biota, including birds and bats, to multiple acoustic stressors that could produce temporary or permanent hearing threshold shift, auditory masking, physiological stress, or behavioral responses. However, acoustic stressors are unlikely to incur substantive costs at the individual or populations level because Naval activities are widely distributed over the Atlantic coast and are intermittent. Individual animals typically would experience a small number of behavioral responses or temporary hearing threshold shifts per year.

There is always substantial uncertainty in predicting the levels of military use of the range complexes in the future as world events unfold. In the near term, the level of military activity will likely remain relatively stable in the AOI, although fiscal trends may place downward pressure on these activities. Civilian space program uses in the region may increase above the present level given the recent expansion of commercial interest in space travel and privatization of previously government responsibilities.

The Navy released its Final EIS on its Atlantic fleet training and testing in September 2018 and concluded and identified IPFs that could affect birds and bats (Navy 2018).

Physical Disturbance and Strikes during training and testing but resulting in no long-term species or population level impacts due to few birds affected over large areas of operation.

Entanglement can impact birds but with a low likelihood due to the relatively small quantities of materials that could cause entanglement, the large area over which they are dispersed, and depth zones outside the range or foraging abilities of most birds. Individuals may be impacted, but no population-level effects are expected.

Ingestion. Could produce impacts if persistent expended materials were accidentally ingested by birds. This is a low probability event because foraging depths of diving birds is generally restricted to the surface or shallow depths; these materials are unlikely to be mistaken for prey, and most material remains near the sea surface for only a short duration. No population-level effect to any bird species is anticipated.

The IPFs of military and civilian space uses that are most likely to potentially interact with OCS wind energy development and are relevant to birds and bats are accidental releases, discharges, and several types of acoustic stressors. The interaction of IPFs of military activities with wind energy development IPFs is not anticipated to be common because wind energy development activities will not be located near naval training or testing areas and thus will occur in different geographic areas. For highly mobile or migratory species there is the possibility they could be affected from naval activities and then again affected by wind energy development activities if they transit both areas. Such interactions are expected to be low frequency events.

### *Oil and gas surveys and extraction*

The Atlantic has seen minimal oil and gas development interest and activity from the 1970s through the present. The current five-year OCS oil and gas lease sale plan has no lease sales scheduled through 2022. Any projections for future leasing in the Atlantic would be speculative. Therefore, the cumulative impact scenario considers only the impacts of G&G activities. When leases sales are conducted, the full list of oil and gas development- related IPFs will need to be assessed.

G&G survey activities are allowable in the region, though restrictions apply to some areas. BOEM has received several permit requests for G&G surveys in support of oil and gas exploration and industry has expressed interest in expanding activities on the Atlantic OCS (BOEM 2019e). IPFs that impact birds and bats include noise from vessels and seismic surveys. BOEM assessed impacts to birds from G&G surveys (BOEM, 2014a) and concluded:

- The primary potential for impact to marine and coastal birds from airguns and other active acoustic electromechanical sources is to seabirds and waterfowl that dive below the water surface and are exposed to underwater noise. Piping plover and red knot are shorebirds unlikely occur near G&G activities as they migrate at heights far above G&G activities. Roseate terns are a pelagic species and come on land only to nest and roost and they forage in shallow waters by plunge-diving, contact-dipping, or surface-dipping. The Bermuda petrel occurs in the AOI; they typically remain aerial and rarely land on the sea surface and feed by snatching prey from the sea surface. Active acoustic sound sources used for G&G activities are highly directive with very narrow beam widths, reducing exposure of bird species other than plunge diving species. Because of these factors, other species of seabirds, waterfowl, and shorebirds would not be affected by active acoustic sound sources.
- Some seabirds and waterfowl either rest on the water surface or shallow dive for only short durations. The short exposure time for shallow-dive birds and lower sound energy level that these diving birds could be exposed to would result in a negligible impact. Diving seabirds and waterfowl could be susceptible to active acoustic sounds generated from seismic airgun surveys. However, seismic pulses are directed downward, highly attenuated near the surface, and have a limited potential for direct impact from airgun surveys. Mortality or life-threatening injury is not expected, and little disruption of behavioral patterns or other non-injurious effects would occur, resulting in a negligible impact.
- There is the potential for minor, temporary displacement of coastal and marine bird species or their prey from a portion of feeding areas during non-migration seasons that would resulting in negligible impacts. However, if airgun surveys cause displacement from preferred feeding areas during migration, then the impact would be considered minor.

The interaction of oil and gas extraction G&G IPFs and wind energy development IPFs can be minimized by timing and location considerations. Seismic surveys can extend over a time scale of months, as does construction and installation of wind energy structures. However, identifying the locations and schedules of wind energy G&G and construction/installation activities and of oil and gas G&G activities could avoid overlapping impacts by scheduling activities to avoid cumulative impacts to birds.

### *Renewable energy development, wind*

Wind energy development is expected to continually increase in the foreseeable future along the entire Atlantic coast of the U.S. Currently, there is one operating wind energy facility, the Block Island Wind Farm BOEM currently has 15 active commercial leases and one active research lease offshore the East Coast of the U.S. The OCS-A 0508 lease for the Kitty Hawk, North Carolina Offshore Wind/Avangrid project, is in the South Atlantic AOI.

BOEM has changed its criteria for inclusion of projects in its cumulative impacts scenario as being reasonably foreseeable. BOEM now includes in its reasonably foreseeable future: all projects with COPs submitted or approved, with offtake awarded, or for which the developer has publicly announced plans of development; any additional development to fulfill the remaining, announced offshore wind solicitations; and he more likely of the remaining planned Atlantic state solicitations. Currently, these projects account for some 17GW in offshore wind energy production.

Wind energy development has the potential to produce impacts from site characterization studies (i.e., G&G surveys without airguns), site assessment data collection activities that involve installation of meteorological towers or buoys and installation and operation of turbine structures. The IPFs relevant to impacts on the birds and bats environment are:

- *Site characterization surveys.* G&G survey IPFs include: accidental releases; air emissions, discharges, HRG (no airguns) surveys, and vessel traffic.
- *Site assessment studies: installation of meteorological towers and/or buoys.* Site assessment studies have the same IPFs as G&G surveys except for noise from HRG surveys. In addition, site assessment related IPFs include: onshore and offshore air emissions, discharges construction/ installation impacts, noise, port utilization; traffic; and presence of structures.
- *Installation/Decommissioning of turbine structures*. Installation of turbines will have all of the IPFs described for site assessment studies but also include accidental releases, impacts from scour protection, energy generation, new cable emplacement, noise from O&M, decommissioning/structure removal noise and vessel traffic, presence of structure impacts, and turbine bird and bat strikes.

While birds may be affected by vessel traffic and discharges, the presence of meteorological towers and buoys, noise, vessel discharges, and accidental fuel releases offshore, wind energy development activities pose no threat of significant impacts**.** The risk of collisions with meteorological towers is minor due to the small number and size of the towers and their distance from shore and between each other. The impact of meteorological buoys is much smaller and closer to the sea surface than meteorological towers and their impacts less than those of towers. BOEM determined for its Mid-Atlantic wind energy lease sale that impacts to ESA-listed and non-ESA listed migratory birds is expected to be negligible from towers and buoys. USFWS concurred with BOEM’s determination for Roseate tern and piping plover but requested BOEM to provide additional consideration regarding the Bermuda petrel in light of new data on potential seasonal occurrence near the Virginia WEA. Bats may occasionally be driven offshore by prevailing winds and weather but rarely are expected to forage or migrate through WEAs. Bats may present either avoidance or attraction behaviors near towers. Any impacts to individuals would not be sufficient to affect the sustainability of the populations.

For OCS wind energy development in the South Atlantic, BOEM currently has determined there are no reasonably foreseeable offshore wind development. Consequently, OCS wind energy development in the South Atlantic is not projected to impact any potentially affected resource nor interact with any actions or activities included in the cumulative impacts scenario.

### Submarine cables, transmission/telecommunication lines, pipelines

As of December 2012, NOAA charted three submarine telecommunications cables in the South Atlantic: two near Titusville, Florida and one near Jacksonville, Florida (Figure 3-19). Two additional fiberoptic cables were recently installed in 2014 and 2015; both make landfall near Jacksonville, Florida. Two cables originate in Virginia Beach and run along the North Carolina coast and through Pamlico Sound but do not make landfall in North Carolina. Not all of these cables are necessarily utilized as the NOAA listings include both active and out of service cables.

Relatively speaking, there are few submarine cables in the South Atlantic as compared to the North and Mid-Atlantic. Submarine telecommunications cables are consistently being upgraded, enhanced, and expanded as circuit capacity is used up or current cables reach the end of their effective lifespan. Replacement and repair of existing cables are also ongoing and are expected to continue in the foreseeable future. Thus, the expected trend for submarine cables is that activity will remain static or there may be a small increase in activity. There are six pending submarine cable installation applications with the FCC; none are located in the South Atlantic.

Future seabed cable, line, and pipeline activity appears to be dynamic and is likely to interact with wind energy IPFs. Most of this activity will be located close to shore and an investigation of future application approvals and the routes of these transmission connections will require reviewed.

The IPFs of seabed cables, lines, and pipelines and offshore wind energy that may affect birds and bats include accidental releases and noise. Accidental releases will generally be small in extent, offshore wind vessel activity is relatively low, and such events are short-lived, infrequent, widely dispersed, and spatially localized, so impacts are considered to be minor to negligible. The IPFs most important to birds and bats are noise related to the onshore and offshore construction. These impacts will be temporary and localized.

### *Climate change*

As described in Section 3.8, climate change disrupts geophysical and biological resources globally. Climate change may directly or indirectly alter the impacts of IPFs that affect birds and bats, especially changes to coastal habitat, from habitat alterations caused by warming to the requirement for protective measures and restoring damage from storms. Long-term biophysical and climate trends indicate that coastal states will likely be subject to continued shoreline erosion, higher sea levels, and loss of natural coastal buffers. To the degree wind energy development offsets the use of fossil fuel used to generate power, it will reduce carbon emissions and further efforts to reduce global warming.

### 4.3.2.2 Coastal Habitats

**Table 4-7. Cumulative Impacts Scenario IPFs – Coastal Habitats**

| | Dredge Material Ocean Disposal | Commercial and Recreational Fishing | Land Use /Coastal Infrastructure | Marine Minerals Extraction | Marine Transportation, Navigation, and Traffic | Military Ranges & Civilian Space Program Uses | Oil and Gas Surveys and Extraction | Renewable Energy-Wind | Submarine Cables, Lines, & Pipelines | Climate Change |
|---|---|---|---|---|---|---|---|---|---|---|
| **Offshore Wind Energy Development IPFs** | | | | | | | | | | |
| Accidental releases | ● | ● | ● | ● | ● | ● | ● | ● | ● | |
| Air emissions | ● | ● | ● | | ● | ● | ● | ● | ● | |
| Discharges | ● | ● | ● | ● | ● | ● | ● | ● | ● | |
| Light | | ● | ● | | ● | ● | ● | ● | | |
| New cable emplacement/maintenance | | | | | | | | ● | ● | ● |
| Noise | ● | ● | ● | ● | ● | ● | ● | ● | ● | |
| Port utilization | ● | | | | ● | | ● | ● | | ● |
| Presence of structures | | | ● | | | ● | ● | ● | ● | ● |
| **Cumulative Impact Scenario, Other IPFs** | | | | | | | | | | |
| Beach restoration | ● | | | ● | | | | | | ● |
| Bycatch | | ● | | | | | | | | |
| Gear utilization | | ● | | ● | | ● | | | | ● |
| Land disturbance | | | ● | | | | ● | | | ● |
| Ocean acidification | | | | | | | | | | ● |
| Port utilization, maintenance, dredging | ● | | | | | | | | | ● |
| Pipeline trenching | | | | | | | ● | | | |
| Regulated fishing effort | | ● | | | | | | | | ● |
| Resource exploitation | | ● | | | | | | | | ● |
| Sediment deposition and burial | ● | | | | | | | | | ● |
| Seabed profile alterations | | | | ● | | | | | | ● |
| Warming and sea-level rise | | | | | | | | | | ● |

The Atlantic coastline consists of a complex range of diverse coastal habitats, including barrier islands, sand spits, beaches, dunes, tidal and non-tidal wetlands, mudflats, and estuaries. Much of the Atlantic shoreline has been substantially altered from development, agriculture, vessel and ground traffic, industry, agriculture, beach replenishment, or shore protection activities.

The South Atlantic coastal states comprise some 17,000 miles of coastal and tidal shorelines, or about 18% of the total U.S. coastline (NOAA 2019). Florida accounts for half of this total (8,436 miles) followed by North Carolina (3,375 miles), South Carolina (2,8790 miles), and Georgia (2,344 miles). The South Atlantic coastline is an irregular mixture of rivers, streams, swamps, estuaries, salt and freshwater marshes, beaches, bays, sounds, and islands. The South Atlantic Fisheries Management Council's Fishery Ecosystem Plan II identifies 12 habitats: artificial reef, shallow water coral, live/hard bottom, deepwater coral, pelagic sargassum, estuarine emergent marsh, mangrove, seagrass/sav, oyster reef and shell, intertidal flats, estuarine water column, and soft bottom subtidal habitats (SAFMC 2019c).

In 2017 BOEM released an extensive review of Atlantic coastal habitats, "*Effects Matrix for Evaluating Potential Impacts of Offshore Wind Energy Development on U.S. Atlantic Coastal Habitats*" (BOEM 2017). This document reviewed then existing information; provided a description of Atlantic coastal habitats;

characterized the environments of BOEM's North, Mid-, and South Atlantic and Straits of Florida Planning Areas; reviewed reasonably foreseeable COP activities and their potential direct and indirect effects; and created a matrix of COP activities and their effects determinations.

### *Dredged material ocean disposal*

There are 8 active projects and 8 inactive/closed projects identified in the South Atlantic AOI (Table 3-10). Ocean disposal of dredge material has decreased as beneficial reuse has increased. USACE reported that about 20% to 30% of port and waterway dredged material is used for habitat creation and other beneficial uses (USACE 2012). With increased port expansion/dredging projects to handle post-Panamax vessels, BOEM expects ocean disposal activity to remain stable or increase.

The IPFs related to ocean disposal relevant to coastal habitat impacts that may interact with wind energy-related IPFs are primarily vessel-derived stressors and include accidental releases; air emissions; discharges; noise; and vessel traffic. Less important IPFs are fuel spills due to their low probability of occurrence and relatively limited spatial impact.

A potential indirect impact on coastal habitat could arise from an increased need for channel maintenance dredging from offshore wind energy vessel traffic. However, in comparison to the number and size of vessels that use the port facilities along the East Coast, the size and traffic anticipated from offshore wind energy development represents a negligible increase in dredging activity due to vessel traffic.

The incremental impacts of offshore wind energy on coastal habitat impacts of ocean disposal of dredge spoils are associated with a need to maintain navigation channels used by offshore wind energy vessel traffic. This impact is expected to be negligible because the contribution of wind energy-related vessel activity to overall marine traffic is expected to be negligible.

### *Commercial and recreational fishing*

In 2017, commercial fisheries harvested approximately 194 million pounds of fish and shellfish in the four-state region (including North Carolina, South Carolina, Georgia and Florida), with a total landed value of over $397 million (2018 dollars); over the period from 2008 to 2017, average annual landings were 190 million pounds with a value of $376 million (NOAA 2019d).  The top five species by landing value in 2017 for the four-state region included for the four-state region included white shrimp, blue crab, Caribbean spiny lobster, pink shrimp, and stone crab (NOAA 2019d). Total values and pounds landed over the past ten years are shown in Figure 3-11, based on data from NOAA Fisheries. Between 2008 and 2017, the value of landings ranged from $305 million to $431 million, while landings weight ranged from 179 million pounds to 210 million pounds.

The IPFs of commercial and recreational fishing relevant to coastal habitat impacts that may interact with offshore wind energy development are all vessel-related: accidental releases; air emissions; waste discharges; noise; and traffic. Vessel traffic from commercial and recreational fishing is a significant contributor to overall vessel traffic along the South Atlantic coast but is expected to remain stable for the foreseeable future.

Vessel traffic associated with offshore wind energy development is a negligible contribution to overall marine traffic that includes commercial and recreational fishing vessel traffic. Offshore wind energy development will not affect commercial or recreational fishing to any material degree. Existing fishing impacts on coastal habitat do not appear to be a substantial contributor to coastal habitat degradation. The impacts of commercial and recreational fishing and any potential interaction with wind energy development are expected to have a negligible impact on coastal habitat.

### *Land use and coastal infrastructure*

Land use on the South Atlantic coast is diverse, encompassing many distinct environments, supporting a wide range of ecosystems, and human activities including recreation, tourism, residential, commercial, and industrial infrastructures. The impact of wind energy development on coastal habitat is mainly driven by any increase in port activity required to meet the demands for fabrication, construction, transportation, installation, and maintenance of wind energy structures.

A DOE assessment report in 2014 used the Port of Morehead City, North Carolina as a case study to estimate the capacity for offshore wind development in the South Atlantic region in the next 10-20 years. The report concluded needed improvements were minimal and if made that one port such as Morehead City would be able to satisfy the port infrastructure requirements to support offshore wind capacity development in the region. That said, DOE also anticipated multiple staging ports would be utilized to minimize transit differences. Also, given the increasing size of offshore wind turbines there may be additional improvements required.

IPFs related to coastal habitat that may interact with wind energy related IPFs and land use and coastal infrastructure are accidental releases, air emissions, discharges, vessel noise, and vessel traffic. The incremental increase from offshore wind development is expected to be a minor contributor to overall coastal activity compared to commercial, industrial, and recreational inputs.

### *Marine minerals extraction*

Data on projected sand mining activity, based on current lease agreements, indicate a stable or slightly increasing trajectory through 2020. There are two active leases both of which are located offshore Brevard County, Florida and one lease request that is offshore Flagler County, Florida. There is currently one large (2.2 million cu yd) active lease located off Virginia Beach, Virginia. The lease is less than 50 km from the North Carolina border and could potentially interact with wind energy development activities in the northern areas offshore North Carolina.

States also have active minerals mining and channel dredging activities that support numerous local beach renourishment projects. However, the type and availability of data on these projects vary widely at the state and county level. Evaluating the potential interactions with offshore wind energy development and such local projects appears to require real-time effort at state- and county-level offices. The Army Corps of Engineers (USACE 2020).may have the most comprehensive source of information on these local projects at its USACE Jurisdictional Determinations and Permit Decisions website: https://permits.ops.usace.army.mil/orm-public.

IPFs of marine minerals mining relevant to coastal habitat impacts that may overlap with wind energy IPFs are primarily seafloor stressors and include accidental releases; vessel discharges of settleable solids; sediment deposition/burial. Marine minerals mining activities projects may also require geophysical and geotechnical survey activities similar to oil and gas development and related impacts e.g., vessel activity, noise, air emissions, and spills. Vessel anchoring and installation of pilings for wind energy structures could potentially interact with dredging activities but only if located near borrow sites and thus overall have a low probability of interacting with minerals mining activities.

The impact of minerals marine mining on coastal habitat is primarily beneficial as beach and coastal restoration projects provide continued shoreline protection that will be increasingly needed due to increased storm intensity and frequency resulting from climate change. The impact of wind energy development on dredging activity will be negligible and have no impact on the beneficial impact of minerals mining on beach and coastal restoration projects. Any potential conflicts with wind energy development can be managed through planning and siting.

### *Marine transportation*

Marine transportation in the South Atlantic region is diverse. It includes cargo; tug/barge; liquid tanker; dredging; underwater/diving operations; military operations, training, and testing; scientific research; search-and-rescue vessels; and recreational traffic. Commercial and recreational fishing are discussed in detail as a separate element in the cumulative impact scenario on Chapter 3.7.

Vessel call volume remained relatively steady from 2006 to 2015, with no discernible trend, as illustrated in Table 3-17 for select ports and terminals in the South Atlantic and in Figure 3-9 for the five busiest South Atlantic ports. However, USACE has identified the Southeast coast ports as top candidates for economically justified port expansion projects to improve ports capable of handling post-Panamax vessels. Port expansion would involve dredging deeper channels and increasing the size and capabilities of port equipment, e.g., larger winches and cranes and associated power upgrades. If this improvement occurs commercial ship traffic in the Southeast may see a future increase.

IPFs relevant to coastal habitat impacts that overlap wind energy related IPFs include accidental releases; air emissions; discharges; noise; port utilization and dredging; and vessel traffic. Of these, local impacts at ports and terminals (e.g., air emissions and vessel traffic) are the most substantial relative to wind energy development. Marine transportation needs may create port expansion or upgrades due to increased vessel size, which may require land development and habitat loss. Offshore wind energy requirements are currently met along the Atlantic coast and thus play no role in any increased port capabilities. Wind energy impacts on marine transportation and its interaction with coastal habitat impacts are negligible.

### *Military use, military range complexes, civilian space programs*

The Navy represents a significant extensive military use of the coastal and offshore environment; NASA leads the civilian space program’s use offshore Virginia, near the northern border of the South Atlantic AOI, and in the South Atlantic AOI offshore Cape Canaveral, Florida. Military use of coastal and offshore areas is not restricted to the Navy; the Coast Guard, Marines, Air Force, and Army all utilize these areas for operations, training, and testing.

The Navy released its Final EIS on its Atlantic fleet training and testing in September 2018 and concluded impacts from its testing and training activities on coastal habitat would be negligible because of the distance from shore at which its testing and training occur. One exception was that of nearshore training exercises. For this activity, the impact of most concern was air emissions. Because of the brief duration of exercises, relative infrequency of training, and existing air quality, there would be no violations of air quality standards Direct impacts to coastal habitat were not directly addressed but are not likely because the vast majority of testing and training activity occurs far offshore.

There is always substantial uncertainty in predicting the levels of military use of the range complexes in the future as world events unfold. In the near term, the level of military activity will likely remain relatively stable in the AOI, although fiscal trends are placing downward pressure on these activities. Civilian space program uses in the region may increase above the present level given the recent expansion of commercial interest in space travel and privatization of previously government responsibilities.

IPFs of military and civilian space uses relevant to coastal habitat impacts that could overlap with those of wind energy development include: accidental releases; air emissions from aircraft and vessels; construction/installation impacts from anchoring buoys and structures, installing pilings, and dredging; demolition/structure removal; discharges from vessels; aircraft and vessel aircraft noise; noise from operations, e.g., sonar, weapons explosions, etc.; entanglement from operations using fiber optic cables or guidance wires; mortality of fauna in range of target structures; and aircraft and vessel traffic.

### *Oil and gas surveys and extraction*

The Atlantic has seen minimal oil and gas development interest and activity from the 1970s through the present: between 1979 and 1984 eight exploratory wells were drilled with no economically viable discoveries. The current five-year OCS oil and gas lease sale plan has no lease sales scheduled through 2022. Any projections for future leasing in the Atlantic would be speculative. Therefore, the cumulative impact scenario considers only the impacts of G&G activities. When leases sales are conducted, the full list of oil and gas development- related IPFs will need to be assessed.

G&G survey activities are allowable in the region, though restrictions apply to some areas. BOEM has received several permit requests for G&G surveys in support of oil and gas exploration and industry has expressed interest in expanding activities on the Atlantic OCS (BOEM 2019e). The IPFs from G&G surveys relevant to coastal habitat impacts that may overlap with those of offshore wind energy primarily involve noise and vessels: noise from seismic surveys, including airgun blasts, vessel noise, and vessel traffic. G&G survey activities occur far enough offshore to have no direct impact on coastal resources. G&G survey activity is currently supported by existing port capabilities and should not contribute to any port expansion or improvement requirements. A potential increased need for channel maintenance dredging is likely the most significant impact from oil and gas G&G surveys. This impact will have little or no impact on coastal habitat.

The interaction of oil and gas extraction and wind energy development IPFs will primarily occur offshore and can be minimized by timing and location considerations. Identifying the locations and schedules of wind energy G&G and construction/installation activities and of oil and gas G&G activities could avoid overlapping impacts by scheduling activities to avoid cumulative impacts offshore. There is little likelihood that oil and gas G&G surveys or offshore wind energy development will have any material impact on coastal habitat.

### *Renewable energy development, wind*

Wind energy development is expected to continually increase in the foreseeable future. Currently, there is one operating wind energy facility, the Block Island Wind Farm BOEM currently has 15 active commercial leases and one active research lease offshore the East Coast of the U.S. The OCS-A 0508 lease for the Kitty Hawk, North Carolina Offshore Wind/Avangrid project, is in the South Atlantic AOI.

BOEM has changed its criteria for inclusion of projects in its cumulative impacts scenario as being reasonably foreseeable. BOEM now includes in its reasonably foreseeable future: all projects with COPs submitted or approved, with offtake awarded, or for which the developer has publicly announced plans of development; any additional development to fulfill the remaining, announced offshore wind solicitations; and he more likely of the remaining planned Atlantic state solicitations. Currently, these projects account for some 17 GW in offshore wind energy production.

Wind energy development has the potential to produce impacts from site characterization studies (i.e., G&G surveys without airguns), site assessment data collection activities that involve installation of meteorological towers or buoys and installation and operation of turbine structures. The IPFs relevant to impacts on coastal habitats are:

- *Site characterization surveys.* G&G survey IPFs include: accidental releases; discharges, and vessel traffic
- *Site assessment studies: installation of meteorological towers and/or buoys.* Site assessment studies have the same IPFs as G&G surveys. In addition, site assessment related IPFs include: onshore and offshore air emissions, discharges, construction/ installation impacts, seabed alterations, noise, port utilization; traffic; and presence of structures.
- *Installation/Decommissioning of turbine structures*. Installation of turbines will have all of the IPFs described for site assessment studies but also include accidental releases, energy generation, new cable emplacement, and structure decommissioning/removal noise and vessel traffic.

The interaction between wind energy development IPFs and coastal habitats is regulated by BOEM, which can minimize impacts by locating and scheduling activities to avoid cumulative impacts to coastal habitats.

For OCS wind energy development in the South Atlantic, BOEM currently has determined there are no reasonably foreseeable offshore wind development. Consequently, OCS wind energy development in the South Atlantic is not projected to impact any potentially affected resource nor interact with any actions or activities included in the cumulative impacts scenario.

### *Submarine cables, transmission/telecommunication lines, pipelines*

As of December 2012, NOAA charted three submarine telecommunications cables in the South Atlantic: two near Titusville, Florida and one near Jacksonville, Florida (Figure 3-19). Two additional fiberoptic cables were recently installed in 2014 and 2015; both make landfall near Jacksonville, Florida. Two cables originate in Virginia Beach and run along the North Carolina coast and through Pamlico Sound but do not make landfall in North Carolina. Not all of these cables are necessarily utilized as the NOAA listings include both active and out of service cables.

Relatively speaking, there are few submarine cables in the South Atlantic as compared to the North and Mid-Atlantic. Submarine telecommunications cables are consistently being upgraded, enhanced, and expanded as circuit capacity is used up or current cables reach the end of their effective lifespan. Replacement and repair of existing cables are also ongoing and are expected to continue in the foreseeable future. Thus, the expected trend for submarine cables is that activity will remain static or there may be a small increase in activity. There are six pending submarine cable installation applications with the FCC; none are located in the South Atlantic.

Submarine cables, lines, and pipeline IPFs relevant to coastal habitat impacts that may overlap with those of wind energy development include: accidental releases; air emissions from vessels; installation of new subsea cables; vessel discharges; electromagnetic fields; vessel and construction noise; presence of structure impacts such as offshore and onshore new cable infrastructure; and vessel traffic.

Future seabed cable, line, and pipeline activity appears to be dynamic and appears likely to interact with wind energy IPFs. Most of this activity will be located close to shore and an investigation of future application approvals and the routes of these transmission connections will require reviewed. The IPFs of seabed cables, lines, and pipelines of note are primarily related to the benthic impacts of installation, maintenance, and repair. However, with respect to coastal habitat impacts, siting and space requirements for onshore connections to telecommunications networks or from offshore wind energy structures to the power distribution grid represent the most significant potential impact on coastal habitat that requires consideration in offshore wind energy development.

### *Climate change*

As described in Section 3.8, climate change disrupts geophysical and biological resources around the world. Climate change may directly or indirectly alter the impacts of IPFs that affect coastal habitat in numerous ways, from habitat alterations from warming to the requirement for protective measures and restoring damage from storms. Long-term biophysical and climate trends indicate that South Atlantic states will likely be subject to continued shoreline erosion, higher sea levels, and loss of natural coastal buffers. To the degree wind energy development offsets the use of fossil fuel used to generate power, it will reduce carbon emissions and further efforts to reduce global warming.

### *4.3.2.3 Benthic Communities*

**Table 4-8. Cumulative Impacts Scenario IPFs – Benthic Communities**

| | Dredge Material Ocean Disposal | Commercial and Recreational Fishing | Land Use /Coastal Infrastructure | Marine Minerals Extraction | Marine Transportation, Navigation, and Traffic | Military Ranges & Civilian Space Program Uses | Oil and Gas Surveys and Extraction | Renewable Energy-Wind | Submarine Cables, Lines, & Pipelines | Climate Change |
|---|---|---|---|---|---|---|---|---|---|---|
| **Offshore Wind Energy Development IPFs** | | | | | | | | | | |
| Accidental releases | ● | ● | ● | ● | ● | ● | ● | ● | ● | |
| Air emissions | ● | ● | ● | | ● | ● | ● | ● | ● | |
| Anchoring | | | | | | ● | ● | ● | | |
| Discharges | ● | ● | ● | ● | ● | ● | ● | ● | ● | |
| Electromagnetic fields | | | | | | | | ● | ● | ● |
| Energy generation, energy security | | | | | | | | ● | | ● |
| New cable emplacement/maintenance | | | | | | | | ● | ● | ● |
| Port utilization | ● | | | | ● | | ● | ● | | ● |
| Presence of structures | | | ● | | | ● | ● | ● | ● | ● |
| Traffic | ● | ● | ● | ● | ● | ● | ● | ● | ● | |
| **Cumulative Impact Scenario, Other IPFs** | | | | | | | | | | |
| Beach restoration | ● | | | ● | | | | | | ● |
| Demolition/structure removal | | | | | | ● | ● | | | |
| Energy stressors/devices/lasers | | | | | | ● | | | | |
| Gear utilization | | ● | | ● | | ● | | | | ● |
| Ingestion | | | | | | ● | | | | |
| Ocean acidification | | | | | | | | | | ● |
| Pipeline trenching | | | | | | | ● | | | |
| Resource exploitation | | ● | | | | | | | | ● |
| Sediment deposition and burial | ● | | | | | | | | | ● |
| Seabed profile alterations | | | | ● | | | | | | ● |
| Warming and sea-level rise | | | | | | | | | | ● |

Benthic community impacts occur from multiple activities, including commercial finfish and shellfish bottom fisheries, navigational and port channel maintenance dredging and dredge spoil disposal, beach re-nourishment dredging, residential and commercial coastal development. They can also be influenced by the quality of the water and sediment from rivers. OCS wind energy development can affect benthic communities through anchoring, setting of piles for jackets, monopoles, or gravity-based systems for tower stabilization, emplacement of seabed transmission cables and armoring of transmission cables that aren't buried below minimum sub-seabed depths, armoring of structures for scour protection.

#### *Dredged material ocean disposal*

There are 8 active projects and 8 inactive/closed projects identified in the South Atlantic AOI (Table 3-10). Ocean disposal of dredge material has decreased as beneficial reuse has increased. USACE reported that about 20% to 30% of port and waterway dredged material is used for habitat creation and other beneficial uses (USACE 2012). With increased port expansion/dredging projects to handle post-Panamax vessels, BOEM expects ocean disposal activity to remain stable or increase.

The IPFs of ocean disposal relevant to benthic impacts that may interact with wind energy related IPFs are primarily seafloor stressors and include accidental releases; vessel discharges of settleable solids; and sediment deposition/burial. Vessel anchoring and installation of pilings for wind energy structures could potentially interact with disposal activities but only if located near disposal sites and thus overall have a low probability of interacting with ocean disposal benthic impacts.

The benthic impacts of ocean disposal are the intentional sediment deposition and burial from the release of dredge spoils. Benthic impacts are managed through restricting ocean disposal to sites designated by EPA and managed by USACE through its issuance of ocean disposal permits. EPA and USACE also minimize benthic impacts by EPA setting the standards for assessing the acceptability of dredge spoils that USACE then implements through its permitting process. EPA concurrence is required for USACE ocean disposal permits.

The incremental impacts of offshore wind energy on benthic impacts of ocean disposal of dredge spoils would be associated with a need to maintain navigation channels used by offshore wind energy vessel traffic. The contribution of wind energy-related vessel activity to overall marine traffic is expected to be negligible, and the impact on the benthic impacts of dredge spoil disposal similarly negligible.

### *Commercial and Recreational Fishing*

In 2017, commercial fisheries harvested approximately 194 million pounds of fish and shellfish in the four-state region (including North Carolina, South Carolina, Georgia and Florida), with a total landed value of over $397 million (2018 dollars); over the period from 2008 to 2017, average annual landings were 190 million pounds with a value of $376 million (NOAA 2019d). The top five species by landing value in 2017 for the four-state region included for the four-state region included white shrimp, blue crab, Caribbean spiny lobster, pink shrimp, and stone crab (NOAA 2019d). Total values and pounds landed over the past ten years are shown in Figure 3-11, based on data from NOAA Fisheries. Between 2008 and 2017, the value of landings ranged from $305 million to $431 million, while landings weight ranged from 179 million pounds to 210 million pounds.

The IPFs of commercial and recreational fishing relevant to benthic community impacts that may interact with offshore wind energy development are seafloor stressors: use of bottom trawl gear; vessel discharges of settleable solids; sediment deposition/burial; and vessel anchoring and installation of pilings for wind energy structures.

Future benthic impacts from commercial fishing are expected to remain at current levels as there is no discernable trend for commercial fishing landings. The bottom impacts from offshore wind energy development are mainly restricted to bottom impacts from anchoring during construction/installation of pilings for towers of bottom anchoring of meteorological buoys. Potential impacts from wind energy-related activities are small in comparison to that from commercial fishing activity and wind energy-related impacts are expected to be negligible.

### *Land use and coastal infrastructure*

Land use on the South Atlantic coast is diverse, encompassing many distinct environments, supporting a wide range of ecosystems, and human activities including recreation, tourism, residential, commercial, and industrial infrastructures. The interaction of wind energy development and land use IPFs primarily relates to the increase in port activity required to meet the demands for fabrication, construction, transportation, installation, and maintenance of wind energy structures. Connections to the power grid also may impact local land use and development.

A DOE assessment report in 2014 used the Port of Morehead City, (North Carolina as a case study to estimate the capacity for offshore wind development in the South Atlantic region in the next 10-20 years. The report concluded needed improvements were minimal and if made that one port such as Morehead City would be able to satisfy the port infrastructure requirements to support offshore wind capacity development in the region. That said, DOE also anticipated multiple staging ports would be utilized to minimize transit differences. Also, given the increasing size of offshore wind turbines there may be additional improvements required.

The impact of wind energy development on land use requirements primarily relate to the increase in port activity required to meet the demands for fabrication, construction, transportation and installation of wind energy structures. This includes site assessment and characterization studies through turbine and distribution platform installation; seabed transmission line emplacement; and onshore substation connections. The general trend along the South Atlantic coastal is that port activity will increase modestly. The ability of ports to receive the increase in larger ships will require modifications to cargo handling equipment and conversion of some undeveloped land to meet port demand. The incremental increase from offshore wind development will be a minor contributor to any port expansion required to meet commercial, industrial, and recreational demand. The current bearing capacity of existing ports was considered suitable for wind turbines, requiring no port modifications for supporting offshore wind energy development (DOE, 2014).

IPFs related to land use and coastal infrastructure relevant to benthic impacts that may interact with wind energy related IPFs include land disturbance/development with habitat loss. These impacts will be spatially limited to the area near the port. The incremental contribution of offshore wind energy development is expected to be small compared to the needs for port expansion or handling improvements derived from marine transportation. Residential and commercial coastal development may result in a greater demand for beach and coastal restoration projects, with its associated increase in dredging activity and ship traffic due to offshore sand and gravel mining. Benthic impacts from marine minerals mining are limited to designated borrow areas.

### *Marine minerals extraction*

Data on projected sand mining activity, based on current lease agreements, indicate a stable or slightly increasing trajectory through 2020. There are two active leases both of which are located offshore Brevard County, Florida and one lease request that is offshore Flagler County, Florida. There is currently one large (2.2 million cu yd) active lease located off Virginia Beach, Virginia. The lease is less than 50 km from the North Carolina border and could potentially interact with wind energy development activities in the northern areas offshore North Carolina.

Project-level dredging activities and wind energy construction and installation activities are typically relatively short-term efforts−one or two years. However, dredging for a series of beach restoration projects is possible and could result in longer-term impacts. Thus, specific minerals mining projects need to be assessed if the wind energy lease is near active borrow sites.

States also have active minerals mining and channel dredging activities that support numerous local beach renourishment projects. However, the type and availability of data on these projects vary widely at the state and county level. Evaluating the potential interactions with offshore wind energy development and such local projects appears to require real-time effort at state- and county-level offices. The Army Corps of Engineers (USACE 2020).may have the most comprehensive source of information on these local projects at its USACE Jurisdictional Determinations and Permit Decisions website: https://permits.ops.usace.army.mil/orm-public.

IPFs of marine minerals mining relevant to benthic impacts that may overlap with wind energy IPFs are primarily seafloor stressors and include accidental releases; vessel discharges of settleable solids; and sediment deposition/burial. Vessel anchoring and installation of pilings for wind energy structures could potentially interact with disposal activities but only if located near borrow sites and thus overall have a low probability of interacting with ocean disposal benthic impacts. BOEM regulates potential benthic impacts by restricting sand mining to authorized areas for specific periods of time. The impacts of offshore wind energy on the benthic impacts of marine minerals mining are expected to be negligible.

### *Marine transportation*

Marine transportation in the South Atlantic region is diverse. It includes cargo; tug/barge; liquid tanker; dredging; underwater/diving operations; military operations, training, and testing; scientific research; search-and-rescue vessels; and recreational traffic. Commercial and recreational fishing are discussed in detail as a separate element in the cumulative impact scenario in Chapter 3.7.

Vessel call volume remained relatively steady from 2006 to 2015, with no discernible trend, as illustrated in Table 3-17 for select ports and terminals in the South Atlantic and in Figure 3-9 for the five busiest South Atlantic ports. However, USACE has identified the Southeast coast ports as top candidates for economically justified port expansion projects to improve ports capable of handling post-Panamax vessels. Port expansion would involve dredging deeper channels and increasing the size and capabilities of port equipment, e.g., larger winches and cranes and associated power upgrades. If this improvement occurs commercial ship traffic in the Southeast may see a future increase.

IPFs of marine transportation relevant to benthic community impacts that may overlap wind energy related IPFs include accidental releases; port utilization and channel maintenance dredging; and vessel discharges of settleable solids. The most important IPF of marine transportation is the need for maintenance dredging of navigation channels and the associated requirement for ocean disposal of the dredge spoils. Offshore wind energy development in not likely to interact with the benthic impacts of marine transportation, such as ship channel wake erosion, because they are unlikely to be sited close enough to shipping lanes or channels for their impacts to interact. Because marine transportation appears to have a stable trajectory and current activity appears compatible with maintaining the benthic community impact status quo, future impacts are likely to be negligible.

### *Military use, military range complexes, civilian space programs*

The Navy represents a significant extensive military use of the coastal and offshore environment; NASA leads the civilian space program’s use offshore Virginia, near the northern border of the South Atlantic AOI, and in the South Atlantic AOI offshore Cape Canaveral, Florida. Military use of coastal and offshore areas is not restricted to the Navy; the Coast Guard, Marines, Air Force, and Army all utilize these areas for operations, training, and testing.

There is always substantial uncertainty in predicting the levels of military use of the range complexes in the future as world events unfold. In the near term, the level of military activity will likely remain relatively stable in the AOI, although fiscal trends are placing downward pressure on these activities. Civilian space program uses in the region may increase above the present level given the recent expansion of commercial interest in space travel and privatization of previously government responsibilities.

IPFs of military and civilian space uses that are relevant to benthic community impacts and could overlap with those of wind energy development include: accidental releases; construction/installation impacts from vessels and anchoring buoys and structures, installing pilings, and dredging; and demolition/structure removal.

The Navy released its Final EIS on its Atlantic fleet training and testing in September 2018 and concluded benthic impacts to sediment quality and invertebrates could result from chemical contamination of sediments, acoustics, explosions, energy stressors, and physical disturbance. Chemical changes resulting from explosions, chemicals other than explosives, metals, and other expended materials are not likely to be detectible and similar in concentration of chemical and material residue from nearby reference sites or may be detectable but would be below applicable regulatory standards for determining effects on biological resources. Impacts from acoustic, energy stressors, explosions, and physical disturbance would be localized near the site of the activity; impacts on individuals are expected but not at the population level due to the limited spatial extent of disturbances, their relatively infrequent occurrence, and dynamic nature of benthic communities.

### *Oil and gas surveys and extraction*

The Atlantic has seen minimal oil and gas development interest and activity from the 1970s through the present: between 1979 and 1984 eight exploratory wells were drilled with no economically viable discoveries. The current five-year OCS oil and gas lease sale plan has no lease sales scheduled through 2022. Any projections for future leasing in the Atlantic would be speculative. Therefore, the cumulative impact scenario considers only the impacts of G&G activities. When leases sales are conducted, the full list of oil and gas development- related IPFs will need to be assessed.

G&G survey activities are allowable in the region, though restrictions apply to some areas. BOEM has received several permit requests for G&G surveys in support of oil and gas exploration and industry has expressed interest in expanding activities on the Atlantic OCS (BOEM 2019e). The IPFs of oil and gas G&G surveys that overlap with those of offshore wind energy and affect benthic communities primarily involve noise: airgun blasts that could potentially affect benthic invertebrates. BOEM concluded that only limited impacts to soft bottom benthic organisms were expected to be detectable and no overall changes in species composition, community structure, and/or ecological functioning of soft bottom communities was expected and impacts to benthic communities from active acoustic sound sources would be negligible.

### *Renewable energy development, wind*

Wind energy development is expected to continually increase in the foreseeable future along the entire Atlantic coast of the U.S. Currently, there is one operating wind energy facility, the Block Island Wind Farm BOEM currently has 15 active commercial leases and one active research lease offshore the East Coast of the U.S. The OCS-A 0508 lease for the Kitty Hawk, North Carolina Offshore Wind/Avangrid project, is in the South Atlantic AOI.

BOEM has changed its criteria for inclusion of projects in its cumulative impacts scenario as being reasonably foreseeable. BOEM now includes in its reasonably foreseeable future: all projects with COPs submitted or approved, with offtake awarded, or for which the developer has publicly announced plans of development; any additional development to fulfill the remaining, announced offshore wind solicitations; and the more likely of the remaining planned Atlantic state solicitations. Currently, these projects account for some 17 GW in offshore wind energy production.

Wind energy development has the potential to produce impacts from site characterization studies (i.e., G&G surveys without airguns), site assessment data collection activities that involve installation of meteorological towers or buoys and installation and operation of turbine structures. Wind energy development has the potential to produce impacts from site characterization studies (i.e., G&G surveys without airguns), site assessment data collection activities that involve installation of meteorological towers or buoys and installation and operation of turbine structures. The IPFs relevant to impacts on the benthic communities are:

- *Site characterization surveys.* G&G survey IPFs include: accidental releases and discharges.
- *Site assessment studies: installation of meteorological towers and/or buoys.* Site assessment studies have the same IPFs as G&G surveys plus site assessment-related IPFs including discharges construction/ installation impacts, seabed alterations, and presence of structures.
- *Installation/Decommissioning of turbine structures*. Installation of turbines will have all of the IPFs described for site assessment studies but also include impacts from scour protection, electromagnetic fields, new cable emplacement, noise from O&M, decommissioning/structure removal, noise and vessel traffic, and presence of structure impacts.

The interaction between wind energy development IPFs and benthic communities is determined by BOEM, which regulates wind development locations and activities and can minimize impacts by locating and scheduling activities to avoid cumulative impacts to marine minerals resources.

Incremental impacts on benthic communities from offshore wind development would be localized to the area surrounding the tower or buoy and most pronounced during construction/installation phase for towers, buoys, and new submarine cables and lines. Recovery would be expected after cessation of construction/installation/emplacement and benthic community impacts from wind energy development are expected to be negligible.

For OCS wind energy development in the South Atlantic, BOEM currently has determined there are no reasonably foreseeable offshore wind development. Consequently, OCS wind energy development in the South Atlantic is not projected to impact any potentially affected resource nor interact with any actions or activities included in the cumulative impacts scenario.

### *Submarine cables, transmission/telecommunication lines, pipelines*

As of December 2012, NOAA charted three submarine telecommunications cables in the South Atlantic: two near Titusville, Florida and one near Jacksonville, Florida (Figure 3-19). Two additional fiberoptic cables were recently installed in 2014 and 2015; both make landfall near Jacksonville, Florida. Two cables originate in Virginia Beach and run along the North Carolina coast and through Pamlico Sound but do not make landfall in North Carolina. Not all of these cables are necessarily utilized as the NOAA listings include both active and out of service cables.

Relatively speaking, there are few submarine cables in the South Atlantic as compared to the North and Mid-Atlantic. Submarine telecommunications cables are consistently being upgraded, enhanced, and expanded as circuit capacity is used up or current cables reach the end of their effective lifespan. Replacement and repair of existing cables are also ongoing and are expected to continue in the foreseeable future. Thus, the expected trend for submarine cables is that activity will remain static or there may be a small increase in activity. There are six pending submarine cable installation applications with the FCC; none are located in the South Atlantic.

Submarine cables, lines, and pipeline IPFs relevant to benthic community impacts that may overlap with those of offshore wind energy development include: installation of new subsea cables; electromagnetic fields; presence of structure impacts from new cable infrastructure; seabed alterations from anchoring, driving pilings, and setting foundations for buoys; and noise from driving pilings and setting of buoys.

Future seabed cable, line, and pipeline activity appears to be dynamic and will interact with offshore wind energy development in the emplacement of transmission lines to onshore power distribution systems. The siting of these transmission lines will require coordination with local, state, and federal agencies as well as private interests. Benthic community impacts will be local, not extending far from the transmission line corridor. Impacts are also expected to be transient; recovery is expected to occur, although further benthic disruptions may occur during maintenance, repair, or replacement activities. The benthic impacts of offshore wind energy submarine cables, lines, and pipeline emplacement and maintenance are expected to be minor to negligible.

### *Climate change*

Climate change disrupts geophysical and biological resources globally (see Section 3.8). Climate change may alter the impacts of IPFs that affect benthic communities primarily indirectly, resulting from both community alterations from warming and community disruptions from increased storm intensity and frequency. Increased sand mining and dredge spoil disposal directly affect benthic communities but are limited in their areal extent. To the degree wind energy development offsets the use of fossil fuel used to generate power, it will reduce carbon emissions and further efforts to reduce global warming.

#### *4.3.2.4 Fish, Essential Fish Habitat, and Threatened and Endangered Fish*

**Table 4-9. Cumulative Impacts Scenario IPFs – Fish, EFH, and T&E Fish**

| | Dredge Material Ocean Disposal | Commercial and Recreational Fishing | Land Use /Coastal Infrastructure | Marine Minerals Extraction | Marine Transportation, Navigation, and Traffic | Military Ranges & Civilian Space Program Uses | Oil and Gas Surveys and Extraction | Renewable Energy-Wind | Submarine Cables, Lines, & Pipelines | Climate Change |
|---|---|---|---|---|---|---|---|---|---|---|
| **Offshore Wind Energy Development IPFs** | | | | | | | | | | |
| Accidental releases | ● | ● | ● | ● | ● | ● | ● | ● | ● | |
| Discharges | ● | ● | ● | ● | ● | ● | ● | ● | ● | |
| Electromagnetic fields | | | | | | | | ● | ● | ● |
| Energy generation, energy security | | | | | | | | ● | | ● |
| Light | | ● | ● | | ● | ● | ● | ● | | |
| Noise | ● | ● | ● | ● | ● | ● | ● | ● | ● | |
| Port utilization | ● | | | | ● | | ● | ● | | ● |
| Presence of structures | | | ● | | | ● | ● | ● | ● | ● |
| **Cumulative Impact Scenario, Other IPFs** | | | | | | | | | | |
| Demolition/structure removal | | | | | | ● | ● | | | |
| Energy stressors/devices/lasers | | | | | | ● | | | | |
| Gear utilization | | ● | | ● | | ● | | | | ● |
| Ingestion | | | | | | ● | | | | |
| Ocean acidification | | | | | | | | | | ● |
| Port utilization, maintenance, dredging | ● | | | | | | | | | ● |
| Pipeline trenching | | | | | | | ● | | | |
| Regulated fishing effort | | ● | | | | | | | | ● |
| Resource exploitation | | ● | | | | | | | | ● |
| Sediment deposition and burial | ● | | | | | | | | | ● |
| Seabed profile alterations | | | | ● | | | | | | ● |
| Warming and sea-level rise | | | | | | | | | | ● |

The marine waters of the South Atlantic support a wide variety of marine species, including

- common fish (Atlantic menhaden, bluefish, northern puffer),
- sports fish (black sea bass, red drum, southern flounder),
- rays (Atlantic stingray, cownose ray, southern stingray),
- pelagic fish (marlins, sailfish, tunas),
- reef fish (gag grouper, gray triggerfish, red snapper), and
- sharks (dusky, bull, sandbar).

The SAFMC manages the commercial and recreational fisheries for species within federal waters. Highly migratory species such as marlins, sailfish, and tunas are managed directly by NMFS under the Consolidated Atlantic Highly Migratory Species Fishery Management Plan.

<u>Essential Fish Habitat.</u>

The Magnuson-Stevens Fishery Conservation and Management Act (FCMA) requires fishery management councils to: (1) describe and identify Essential Fish Habitat (EFH) in their respective regions, (2) specify actions to conserve and enhance that EFH, and (3) minimize the adverse effects of fishing on EFH. The 2009

Fishery Ecosystem Plan of the South Atlantic Region (SAFMC 2009) describes the freshwater, estuarine/inshore, and marine/offshore systems that provide EFH for six management plans within the South Atlantic. These include coastal migratory pelagics, shrimp, snapper-grouper complex, spiny lobster, coral and coral reefs, and the golden crab.

Endangered and Threatened Species.

Two fish species presently listed as endangered under the ESA are known to occur within the proposed lease area: smalltooth sawfish and Atlantic sturgeon.

- Smalltooth sawfish. The smalltooth sawfish range has receded greatly over the past, resulting in a single distinct population segment (DPS) in southwest Florida. This area in Florida is where the critical habitat has been designated for this species. Population status in areas north of southern Florida is virtually unknown.
- Atlantic Sturgeon. Adult and subadult Atlantic sturgeon occur in shelf waters during fall and winter months. Evidence from extensive tagging programs indicate that shelf areas less than 70 ft deep offshore of Virginia and North Carolina support concentrations of Atlantic sturgeon during fall and winter months; data are lacking for areas south of Cape Hatteras. Atlantic sturgeon are documented to occur in the watersheds of the Ashepoo, Combahee, and Edisto River Basins southward along the South Carolina, Georgia, and Florida coastal areas to the St. Johns River, Florida. Rivers known to have current spawning populations within the range of the ESA-designated South Atlantic district population segment of the endangered Atlantic sturgeon include the Combahee, Edisto, Savannah, Ogeechee, Altamaha, and Satilla Rivers (NMFS 2013).

**Table 4-10. Threatened, Endangered, Candidate, and Species of Concern, Southwest Atlantic**

| | |
|---|---|
| Shortnose sturgeon (*Acipenser brevirostrum*) | E |
| Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus*) | |
| New York Bight DPS | E |
| Chesapeake Bay DPS | E |
| Carolina DPS | E |
| South Atlantic DPS | E |
| Gulf of Maine DPS | T |
| Giant Manta Ray (*Manta birostris)* | T |
| American eel (*Anguilla rostrata)* | C* |
| Largetooth Sawfish (*Pristis pristis)* | E |
| Smalltooth Sawfish (*Pristis pectinate*) | E |
| Nassau Grouper (*Epinephelus striatus*) | T |
| Oceanic Whitetip Shark (*Carcharhinus longimanus*) | T |
| Scalloped Hammerhead Shark (*Sphyrna lewini*) Central and Southwest Atlantic DPS | T |

*The USFWS is the lead federal agency responsible for conservation of American eel
E: endangered T: threatened C: candidate S: species of concern

### *Dredged material ocean disposal*

There are 8 active projects and 8 inactive/closed projects identified in the South Atlantic AOI (Table 3-10). Ocean disposal of dredge material has decreased as beneficial reuse has increased. USACE reported that about 20% to 30% of port and waterway dredged material is used for habitat creation and other beneficial uses (USACE 2012). With increased port expansion/dredging projects to handle post-Panamax vessels, BOEM expects ocean disposal activity to remain stable or increase.

The IPFs associated with dredge material ocean disposal that are also associated with offshore wind development and are most likely to interact with fish populations are vessel operations (traffic, noise, accidental releases, and discharges) and construction/installation activity and noise. Vessel traffic will concentrate around shoreward routes to and from disposal sites. Wind energy projects located near these sites may need to consider potential combined interactions. However, vessel traffic associated with ocean disposal and wind energy development is a minor contributor to marine noise compared to that from marine transportation, commercial/recreational fishing, and military marine.

Because both listed sturgeon species are demersal, ocean disposal could affect their foraging. However, disposal activity is infrequent and the impact on these fish populations is expected to be negligible. Similarly, vessel traffic, noise, and seafloor disruptions associated with constructing wind energy structures (e.g., anchoring construction vessels, bottom anchored meteorological buoys, driving pilings for meteorological or turbine towers) will cause temporary benthic impacts that may affect these species but the impact is anticipated to be negligible because it is temporary and has an insignificant footprint compared to available forage area. Vessel and construction/installation of structures may cause temporary impacts that are of limited duration and very limited spatial significance. Impacts from fuel spills are expected to be negligible because they are low probability events. Accidental releases of trash and debris likewise are also expected to be low probability events.

### *Commercial and recreational fishing*

In 2017, commercial fisheries harvested approximately 194 million pounds of fish and shellfish in the four-state region (including North Carolina, South Carolina, Georgia and Florida), with a total landed value of over $397 million (2018 dollars); over the period from 2008 to 2017, average annual landings were 190 million pounds with a value of $376 million (NOAA 2019d). The top five species by landing value in 2017 for the four-state region included for the four-state region included white shrimp, blue crab, Caribbean spiny lobster, pink shrimp, and stone crab (NOAA 2019d). Total values and pounds landed over the past ten years are shown in Figure 3-11, based on data from NOAA Fisheries. Between 2008 and 2017, the value of landings ranged from $305 million to $431 million, while landings weight ranged from 179 million pounds to 210 million pounds.

Commercial and recreational fishing IPFs that coincide with those of offshore wind development and may affect fish populations are primarily related to larger vessels used in commercial fishing. These IPFs include noise related to vessel traffic and vessel operations e.g., noise related gear deployment, operations, and retrieval (especially bottom dredges), accidental releases, and discharges. Vessel traffic from commercial and recreational fishing is a significant contributor to overall vessel traffic along the South Atlantic coast but is expected to remain stable for the foreseeable future. The long-term trend for commercial and recreational fishing shows a stable trend in activity levels. The incremental stress on South Atlantic fish populations from offshore wind energy development is expected to produce a negligible impact.

### *Land use and coastal infrastructure*

Land use on the South Atlantic coast is diverse, encompassing many distinct environments, supporting a wide range of ecosystems, and human activities including recreation, tourism, residential, commercial, and industrial infrastructures. The impact of wind energy development on land use requirements primarily relates to the increase in port activity required to meet the demands for fabrication, construction, transportation, installation, and maintenance of wind energy structures. Connections to the power grid also may impact local land use and development.

A DOE assessment report in 2014 used the Port of Morehead City, North Carolina as a case study to estimate the capacity for offshore wind development in the South Atlantic region in the next 10-20 years. The report concluded needed improvements were minimal and if made that one port such as Morehead City would be able to satisfy the port infrastructure requirements to support offshore wind capacity development in the region. That said, DOE also anticipated multiple staging ports would be utilized to minimize transit differences. Also, given the increasing size of offshore wind turbines there may be additional improvements required.

IPFs related to land use and coastal infrastructure and wind energy IPFs that may impact South Atlantic fish populations include accidental releases, discharges, noise, and traffic. The interaction of these activities and potential impacts are spatially limited to the area near port or land development projects. The incremental increase from offshore wind development activity is expected to be a minor contributor to overall port activity compared to commercial, industrial, and recreational inputs and have a negligible impact on South Atlantic fish populations.

### *Marine minerals extraction*

Data on projected sand mining activity, based on current lease agreements, indicate a stable or slightly increasing trajectory through 2020. There are two active leases both of which are located offshore Brevard County, Florida and one lease request that is offshore Flagler County, Florida. There is currently one large

(2.2 million cu yd) active lease located off Virginia Beach, Virginia. The lease is less than 50 km from the North Carolina border and could potentially interact with wind energy development activities in the northern area of the South Atlantic.

States also have active minerals mining and channel dredging activities that support numerous local beach renourishment projects. However, the type and availability of data on these projects vary widely at the state and county level. The Army Corps of Engineers (USACE 2020).may have the most comprehensive source of information on these local projects at its USACE Jurisdictional Determinations and Permit Decisions website: (https://permits.ops.usace.army.mil/orm-public).

Sand mining IPFs that have the potential to interact with wind energy IPFs and fish resources in the South Atlantic include accidental releases, discharges, noise, and traffic. The overlap between the two activities is in potential acoustic impacts from the G&G activities of both sand mining and offshore wind energy.

Noise impacts are related to noise from vessel traffic and operational noise (e.g., HRG surveys). The interaction of minerals mining and wind energy G&G surveys will be temporally limited and could be scheduled to be avoided. These surveys can be spatially extensive, but they are of relatively short duration and could be scheduled to avoid overlapping impacts to the acoustic environment. The potential effects of noise on fishes can be categorized in increasing order of severity as: behavioral responses; masking of biologically important sounds; temporal threshold shifts (hearing loss); physiological/ anatomical effects; and mortality.

Accidental releases are low probability, infrequent events that generally are short-lived, widely dispersed, and spatially localized, so potential impacts are considered minor to negligible. Operational discharges are covered under MARPO, EPA, and USCG regulations all designed to limit potential water and sediment quality impacts.

Project-level dredging activities and wind energy construction and installation activities are typically relatively short-term efforts–one or two years. However, dredging for a series of beach restoration projects is possible and could result in longer-term impacts. Thus, specific minerals mining projects need to be assessed if the wind energy lease is near active borrow sites.

### *Marine transportation*

Marine transportation in the South Atlantic region is diverse, including cargo; tug/barge; liquid tanker; dredging; underwater/diving operations; military operations, training, and testing; scientific research; search-and-rescue vessels; and recreational traffic. Commercial and recreational fishing are discussed in detail as a separate element in the cumulative impact scenario on Chapter 3.7.

Vessel call volume remained relatively steady from 2006 to 2015, with no discernible trend, as illustrated in Table 3-17 for select ports and terminals in the South Atlantic and in Figure 3-9 for the five busiest South Atlantic ports. However, USACE has identified the Southeast coast ports as top candidates for economically justified port expansion projects to improve ports capable of handling post-Panamax vessels. Port expansion would involve dredging deeper channels and increasing the size and capabilities of port equipment, e.g., larger winches and cranes and associated power upgrades. If this improvement occurs commercial ship traffic in the Southeast may see a future increase.

Reviewing the 20-year time series for total recreational fishing effort from 1998 to 2018 shows a modest, long-term increase in total offshore trips but with a dramatic crash from 2007 to 2014 that most likely was caused by poor economic conditions during that period. While the 20-year data suggests a gradual increase in recreational fishing effort from 1998 to 2007 and from 2013 to 2018, recent 10-year trend shows sufficient variability that no clear increasing or decreasing trend is occurring in the South Atlantic AOI. With respect to commercial vessel traffic, although fewer port calls suggest a reduction in noise generation from marine transportation, these larger ships may also create a greater acoustic profile that negates any decrease from less traffic.

IPFs of marine transportation that may overlap with wind energy IPFs and are relevant to the fish populations of the South Atlantic include accidental releases, discharges, noise, port utilization, vessel traffic, and vessel noise. Accidental releases are low probability, infrequent events that generally are short-lived, widely dispersed, and spatially localized, so potential impacts are considered minor to negligible. Operational discharges are covered under MARPO, EPA, and USCG regulations all designed to limit potential water and sediment quality impacts.

Vessel activity from wind energy leases near marine transportation routes may interact to increase overall noise in the vicinity of the WTGs but also from maintenance/emergency trips and G&G surveys. However, wind energy vessel activity is small portion of overall marine traffic. Interactions with G&G surveys have limited durations that reduces their potential interaction with marine transportation and impacts on the acoustic environment.

Noise related to wind energy construction could interact with marine vessel traffic but only to a limited temporal and spatial degree, also reducing potential acoustic impacts. Wind energy development could potentially impact shipping fairways, traffic lanes, and anchorage areas and increase noise near these areas, which already are subject to heavy marine traffic, or could cause them to use other routes, bringing their acoustic impacts into new areas and affecting new fish populations. This concern, however, should be addressed in the scoping and public comment phases of the offshore wind energy leasing process.

### *Military use, military range complexes, civilian space programs*

The Navy represents a significant extensive military use of the coastal and offshore environment; NASA leads the civilian space program's use offshore Virginia, near the northern border of the South Atlantic AOI, and in the South Atlantic AOI offshore Cape Canaveral, Florida. Military use of coastal and offshore areas is not restricted to the Navy; the Coast Guard, Marines, Air Force, and Army all utilize these areas for operations, training, and testing.

The Navy released its Final EIS on its Atlantic fleet training and testing in September 2018. The Navy determined training and testing activities have the potential to expose marine biota to multiple acoustic stressors that could produce temporary or permanent hearing threshold shift, auditory masking, physiological stress, or behavioral responses. However, acoustic stressors are unlikely to incur substantive costs at the individual or populations level because Naval activities are widely distributed over the Atlantic coast and are intermittent. Thus, individual animals typically would experience a small number of behavioral responses or temporary hearing threshold shifts per year.

There is always substantial uncertainty in predicting the levels of military use of the range complexes in the future as world events unfold. In the near term, the level of military activity will likely remain relatively stable in the AOI, although fiscal trends may place downward pressure on these activities. Civilian space program uses in the region may increase above the present level given the recent expansion of commercial interest in space travel and privatization of previously government responsibilities.

The Navy released its Final EIS on its Atlantic fleet training and testing in September 2018 (Navy 2018). The combined impacts under the preferred alternative from all stressors would not be expected to impact fish populations because activities involving more than one stressor are generally short in duration and such activities are dispersed widely throughout the EIS Study Area. Existing conditions would not change considerably, therefore, no impacts on fish populations would occur under the preferred alternative. The Navy also concluded that training and testing activities may affect designated critical habitat for the Atlantic sturgeon and Gulf Sturgeon but would have no effect on designated critical habitat for Atlantic salmon.

The IPFs of military and civilian space uses that are most likely to potentially interact with OCS wind energy development and are relevant to South Atlantic fish populations include accidental releases; construction/ installation noise impacts from vessels and anchoring buoys and structures, installing pilings, and dredging; discharges from vessels; noise from operations (e.g., sonar, weapons explosions, etc.); entanglement from operations using fiber optic cables or guidance wires; mortality of fauna in range of target structures; vessel traffic; and demolition/structure removal.

### *Oil and gas surveys and extraction*

The Atlantic has seen minimal oil and gas development interest and activity from the 1970s through the present: between 1979 and 1984 eight exploratory wells were drilled with no economically viable discoveries. The current five-year OCS oil and gas lease sale plan has no lease sales scheduled through 2022. Any projections for future leasing in the Atlantic would be speculative. Therefore, the cumulative impact scenario considers only the impacts of G&G activities. When leases sales are conducted, the full list of oil and gas development- related IPFs will need to be assessed.

G&G survey activities are allowable in the region, though restrictions apply to some areas. BOEM has received several permit requests for G&G surveys in support of oil and gas exploration and industry has expressed interest in expanding activities on the Atlantic OCS (BOEM 2019e). The IPFs of note related to oil and gas G&G surveys that overlap with those of offshore wind energy development include noise and vessel traffic: noise from seismic surveys (e.g., airgun blasts), vessel noise, vessel traffic, and noise from pile driving and other construction noise. All these IPFs could potentially impact South Atlantic fish populations. The potential effects of noise on fishes can be categorized in increasing order of severity as: behavioral responses; masking of biologically important sounds; temporal threshold shifts (hearing loss); physiological/ anatomical effects; and mortality.

The interaction of oil and gas extraction and wind energy development IPFs can be reduced by timing and location considerations. Oil and gas seismic surveys can extend over a time scale of months, whereas wind energy HRG surveys are typically on a scale of weeks. Identifying the locations and schedules of wind energy G&G and construction/installation activities and comparing them to oil and gas G&G activities could avoid overlapping impacts through appropriate scheduling to avoid cumulative impacts to fish populations, particularly when considering impacts to migrating species.

### *Renewable energy development, wind*

Wind energy development is expected to continually increase in the foreseeable future along the entire Atlantic coast of the U.S. Currently, there is one operating wind energy facility, the Block Island Wind Farm BOEM currently has 15 active commercial leases and one active research lease offshore the East Coast of the U.S. The OCS-A 0508 lease for the Kitty Hawk, North Carolina Offshore Wind/Avangrid project, is in the South Atlantic AOI.

BOEM has changed its criteria for inclusion of projects in its cumulative impacts scenario as being reasonably foreseeable. BOEM now includes in its reasonably foreseeable future: all projects with COPs submitted or approved, with offtake awarded, or for which the developer has publicly announced plans of development; any additional development to fulfill the remaining, announced offshore wind solicitations; and he more likely of the remaining planned Atlantic state solicitations. Currently, these projects account for some 17GW in offshore wind energy production.

Wind energy development has the potential to produce impacts from site characterization studies (i.e., G&G surveys without airguns), site assessment data collection activities that involve installation of meteorological towers or buoys and installation and operation of turbine structures. The IPFs relevant to impacts on the fish populations are:

- *Site characterization surveys.* G&G survey IPFs include: accidental releases, discharges, HRG (no airguns) surveys, and vessel traffic.
- *Site assessment studies:* installation of meteorological towers and/or buoys. Site assessment studies have the same IPFs as G&G surveys except for noise from HRG surveys plus discharges, seabed alterations, noise, traffic, and presence of structures.

- *Installation/Decommissioning of turbine structures.* Installation of turbines will have all of the IPFs described for site assessment studies but also include accidental releases, impacts from scour protection, electromagnetic fields.  new cable emplacement, noise from O&M, decommissioning/structure removal noise and traffic, and presence of structure impacts (fish aggregation).

Potential impacts are associated with accidental releases, discharges, traffic and vessel noise, and operational vessel traffic and noise. Impacts from construction/installation HRG surveys are potentially significant but these impacts are temporally and spatially limited. New cable emplacement could disrupt benthic species that serve as prey for bottom-founded fish. In a revised EA for wind energy lease sale offshore New York, BOEM concluded the following for ESA-listed Atlantic sturgeon

- Impacts from acoustic sound sources from HRG surveys and geotechnical exploration are expected to be minor. A boomer sub-bottom profiler is the only source expected to produce sound within the hearing range of Atlantic sturgeon. Atlantic sturgeon are expected to avoid HRG sources, any avoidance or disruptions to behavior are expected to be temporary.
- Impacts from vessel and equipment noise are expected to be negligible.
- Impacts from vessel traffic are expected to be negligible. Impacts from seafloor disturbances associated with bottom sampling and bottom-anchored monitoring buoys are expected to be negligible.

BOEM also concluded in its revised EA for lease issuance and site assessment offshore Massachusetts that, in most cases, few fish are expected in wind energy G&G site assessment survey areas because of the limited immediate area of sonification and short duration of individual HRG surveys. Thus, potential population-level impacts on fish from HRG surveys are expected to be negligible. During pile-driving activity for tower construction BOEM anticipates the soft start requirement would lead to the majority of fish fleeing the area during construction and return to normal activity in the area post-construction. Those fish that do not flee the immediate action area during the pile-driving procedure could be exposed to lethal SPLs. However, significant effects at the population level are not anticipated.

For OCS wind energy development in the South Atlantic, BOEM currently has determined there are no reasonably foreseeable offshore wind development. Consequently, OCS wind energy development in the South Atlantic is not projected to impact any potentially affected resource nor interact with any actions or activities included in the cumulative impacts scenario.

### *Submarine cables, transmission/telecommunication lines, pipelines*

As of December 2012, NOAA charted three submarine telecommunications cables in the South Atlantic: two near Titusville, Florida and one near Jacksonville, Florida (Figure 3-19). Two additional fiberoptic cables were recently installed in 2014 and 2015; both make landfall near Jacksonville, Florida. Two cables originate in Virginia Beach and run along the North Carolina coast and through Pamlico Sound but make no landfall in North Carolina. Not all these cables are necessarily utilized as the NOAA listings include both active and out of service cables.

Relatively speaking, there are few submarine cables in the South Atlantic as compared to the North and Mid-Atlantic. Submarine telecommunications cables are consistently being upgraded, enhanced, and expanded as circuit capacity is used up or current cables reach the end of their effective lifespan. Replacement and repair of existing cables are also ongoing and are expected to continue to do so in the foreseeable future. Thus, the expected trend for submarine cables is that activity will remain static or there may be a small increase in activity. There are six pending submarine cable installation applications with the FCC; none are in the South Atlantic.

Submarine cables, lines, and pipeline IPFs that may overlap with those of wind energy development and may impact fish populations include accidental releases, discharges, installation of new subsea cables; electromagnetic fields; vessel and construction noise; presence of structure impacts, and vessel traffic and noise.

The IPFs of seabed cables, lines, and pipelines of note are primarily related to the benthic impacts of installation, maintenance, and repair. The level of vessel activity is relatively low; impacts from presence of structures are spatially localized. The noise related IPFs are associated with construction and emplacement of wind energy structures and are temporary and localized. The primary impact of submarine cables, lines, and pipelines result from the trenching operations required to bury these lines. Physical benthic disturbances (i.e., turbidity) is very short-lived. Benthic community disruption is longer lasting and can reduce the populations of pretty species for demersal fish. However, the level of activity is relatively low; impacts from construction of structures are spatially localized and temporary; maintenance, while ongoing, is intermittent and brief in any one area. Benthic disturbances will be a major impact factor and affect the demersal species Nonetheless, these disturbances represent a very small fraction of forage area and are relatively brief. Although individuals may be disturbed population-level impacts are expected to be negligible.

### *Climate change*

Climate change disrupts geophysical and biological resources around the world (see Section 3.8). Climate change may directly or indirectly alter the impacts of IPFs that affect threatened and endangered fish. Warming and ocean acidification may directly alter habitat and the geographic distribution of species; species' ranges may be altered due to changes in food source availability in response to changing ocean temperatures and current patterns. Wind energy development could have a beneficial impact on climate change to the extent its energy generation reduces that from fossil fuels that would otherwise be used to meet power demands.

#### *4.3.2.5 Marine Mammals*

**Table 4-11. Cumulative Impacts Scenario IPFs – Marine Mammals**

| | Dredge Material Ocean Disposal | Commercial and Recreational Fishing | Land Use /Coastal Infrastructure | Marine Minerals Extraction | Marine Transportation, Navigation, and Traffic | Military Ranges & Civilian Space Program Uses | Oil and Gas Surveys and Extraction | Renewable Energy-Wind | Submarine Cables, Lines, & Pipelines | Climate Change |
|---|---|---|---|---|---|---|---|---|---|---|
| **Offshore Wind Energy Development IPFs** | | | | | | | | | | |
| Accidental releases | ● | ● | ● | ● | ● | ● | ● | ● | ● | |
| Discharges | ● | ● | ● | ● | ● | ● | ● | ● | ● | |
| Electromagnetic fields | | | | | | | | ● | ● | ● |
| Energy generation, energy security | | | | | | | | ● | | ● |
| Light | | ● | ● | | ● | ● | ● | ● | | |
| New cable emplacement/maintenance | | | | | | | | ● | ● | ● |
| Noise | ● | ● | ● | ● | ● | ● | ● | ● | ● | |
| Port utilization | ● | | | | ● | | ● | ● | | ● |
| Presence of structures | | | ● | | | ● | ● | ● | ● | ● |
| Traffic | ● | ● | ● | ● | ● | ● | ● | ● | ● | |
| **Cumulative Impact Scenario, Other IPFs** | | | | | | | | | | |
| Demolition/structure removal | | | | | | ● | ● | | | |
| Energy stressors/devices/lasers | | | | | | ● | | | | |
| Gear utilization | | ● | | ● | | ● | | | | ● |
| Ingestion | | | | | | ● | | | | |
| Ocean acidification | | | | | | | | | | ● |
| Pipeline trenching | | | | | | | ● | | | |
| Resource exploitation | | ● | | | | | | | | ● |
| Warming and sea level rise | | | | | | | | | | ● |

Approximately 39 species of marine mammals occur in Atlantic OCS waters from Florida to Maine. The Atlantic Coast's marine mammals include baleen whales (the North Atlantic right whale, blue whale, fin whale, sei whale, and humpback whale, all of which are endangered species), toothed whales (dolphins, porpoises, and the endangered sperm whale), the endangered West Indian manatee, and four species of seals.

The western stock of the North Atlantic right whale (*Eubalaena glacialis*) is the most endangered whale occurring along the Atlantic Coast. This species ranges from wintering and calving grounds in the South Atlantic region to summer feeding, nursery, and mating grounds in New England waters and northward. Three areas have been designated under the ESA as critical habitat: coastal Florida and Georgia; Great South Channel (east of Cape Cod), and portions of Cape Cod Bay.

Blue whales may be found in all oceans of the world, but sightings in the Atlantic OCS waters have been sporadic. The fin whale is an oceanic species that occurs worldwide and is the most abundant of the ESA-listed large whale species in Mid- and North Atlantic waters. Fin whales may calve in the mid-Atlantic region from October to January. The sei whale is an oceanic species that occurs from tropic to polar regions; in Atlantic waters of the U.S., more often seen at more northern latitudes. The humpback whale occurs in all oceans, migrating from a winter range over shallow tropical banks to higher latitudes in the rest of the year.

The sperm whale is found worldwide in deep waters between approximately 60˚N and 60˚S latitudes. Sperm whales occur year-round offshore the Atlantic Coast. Although migratory, its patterns are not as predictable or well understood. The North Atlantic stock ranges from northeast of Cape Hatteras in winter to Georges Bank and into the Northeast Channel region in summer. The Atlantic OCS also supports other nonendangered and nonthreatened cetacean. Approximately 28 species are found in Atlantic OCS waters.

The West Indian manatee primarily uses shallow nearshore areas and estuaries but are also found far up in freshwater tributaries. The majority of the West Indian manatee population along the Atlantic Coast is located in eastern Florida and southern Georgia; it’s typical northern limit is coastal North Carolina although individuals have been observed as far north as New England.

There is one species of seal, the harbor seal, that is found in the South Atlantic. The range of the harbor seal goes as far south as the Carolinas. The harbor seal is nonendangered/nonthreatened but has protected status under the Marine Mammal Protection Act (MMPA) through its range.

### *Dredged material ocean disposal*

There are 8 active projects and 8 inactive/closed projects identified in the South Atlantic AOI (Table 3-10). Ocean disposal of dredge material has decreased as beneficial reuse has increased. USACE reported that about 20% to 30% of port and waterway dredged material is used for habitat creation and other beneficial uses (USACE 2012). With increased port expansion/dredging projects to handle post-Panamax vessels, BOEM expects ocean disposal activity to remain stable or increase.

The IPFs most likely to interact with OCS wind energy development and marine mammals are vessel related (traffic, strikes, noise, accidental releases, and discharges). Vessel traffic will concentrate around shoreward routes to and from disposal sites. Wind energy projects located near these sites may need to consider potential interactions. However, vessel traffic associated with ocean disposal and wind energy development is a minor contributor to marine noise compared to that from marine transportation, commercial/recreational fishing, and military marine. Impacts from fuel spills are expected to be negligible because they are low probability events. Accidental releases of trash and debris likewise are also expected to be low probability events. However, vessel traffic associated with ocean disposal and wind energy development is a minor contributor to vessel operations compared to that from marine transportation, commercial/recreational fishing, and military marine activity.

### *Commercial and recreational fishing*

In 2017, commercial fisheries harvested approximately 194 million pounds of fish and shellfish in the four-state region (including North Carolina, South Carolina, Georgia and Florida), with a total landed value of over $397 million (2018 dollars); over the period from 2008 to 2017, average annual landings were 190 million pounds with a value of $376 million (NOAA 2019d). The top five species by landing value in 2017 for the four-state region included for the four-state region included white shrimp, blue crab, Caribbean spiny lobster, pink shrimp, and stone crab (NOAA 2019d). Total values and pounds landed over the past ten years are shown in Figure 3-11, based on data from NOAA Fisheries. Between 2008 and 2017, the value of landings ranged from $305 million to $431 million, while landings weight ranged from 179 million pounds to 210 million pounds.

Commercial and recreational fishing IPFs that coincide with those of offshore wind development and may affect marine mammals are primarily related to larger vessels used in commercial fishing. IPFs relevant to marine mammals are vessel- and gear-related: accidental releases; waste discharges; noise; fishing gear/bycatch; port utilization; and traffic and associated vessel strikes. Bycatch is a significant population stressor for smaller cetaceans and pinnepeds but is not an IPF of commercial and recreational fishing that could potentially overlap with offshore wind energy development. Vessel traffic from commercial and recreational fishing is a significant contributor to overall vessel traffic along the South Atlantic coast but is expected to remain stable for the foreseeable future. Wind energy IPFs are not expected to interact materially with commercial or recreational fishing impacts and are expected to have a negligible impact on marine mammals.

### Land use and coastal infrastructure

Land use on the South Atlantic coast is diverse, encompassing many distinct environments, supporting a wide range of ecosystems, and human activities including recreation, tourism, residential, commercial, and industrial infrastructures. The impact of wind energy development on land use requirements primarily relates to the increase in port activity required to meet the demands for fabrication, construction, transportation, installation, and maintenance of wind energy structures. Connections to the power grid also may impact local land use and development.

A DOE assessment report in 2014 used the Port of Morehead City, North Carolina as a case study to estimate the capacity for offshore wind development in the South Atlantic region in the next 10-20 years. The report concluded needed improvements were minimal and if made that one port such as Morehead City would be able to satisfy the port infrastructure requirements to support offshore wind capacity development in the region. That said, DOE also anticipated multiple staging ports would be utilized to minimize transit differences. Also, given the increasing size of offshore wind turbines there may be additional improvements required.

IPFs related to land use and coastal infrastructure that may interact with wind energy related IPFs and marine mammals are vessel operations (noise and traffic); accidental releases; and effluent discharges. These impacts will be spatially limited to the area near port. Direct impacts on marine mammals from land use and coastal infrastructure are not likely to be significant. Indirect impacts from port development that leads to increased vessel traffic and the associated potential for vessel strike impacts is possible. The incremental increase in vessel operations from offshore wind development vessel activity is expected to be a minor contributor to overall port activity compared to commercial, industrial, and recreational inputs. Current trends for marine transportation and commercial and recreational fishing indicate stable or modestly increasing levels of activity and little demand for increased port capacity except for port modifications to accommodate post-Panamax ships. The trend of increasing cargo handling and decreasing vessel calls reflect a shift to larger vessels; reducing vessel traffic may have a beneficial impact on incidence of vessel strikes of marine mammals.

Wind energy IPFs are expected to interact with land use and coastal infrastructure to the extent that transmission lines for offshore power generation will require infrastructure to connect to onshore power distribution systems. This interaction is expected to result in little or no change in the potential impact of land use and coastal infrastructure on marine mammals, which is expected to be negligible.

### Marine minerals extraction

Data on projected sand mining activity, based on current lease agreements, indicate a stable or slightly increasing trajectory through 2020. There are two active leases both of which are located offshore Brevard County, Florida and one lease request that is offshore Flagler County, Florida. There is currently one large (2.2 million cu yd) active lease located off Virginia Beach, Virginia. The lease is less than 50 km from the North Carolina border and could potentially interact with wind energy development activities in the northern areas offshore North Carolina.

States also have active minerals mining and channel dredging activities that support numerous local beach renourishment projects. However, the type and availability of data on these projects vary widely at the state and county level. The Army Corps of Engineers (USACE 2020).may have the most comprehensive source of information on these local projects at its USACE Jurisdictional Determinations and Permit Decisions website: https://permits.ops.usace.army.mil/orm-public.

IPFs of marine minerals mining relevant to marine mammals that may overlap with wind energy IPFs include accidental releases; discharges from vessels; noise; and vessel traffic and vessel strikes. Marine minerals mining projects also may require G&G survey activities similar to oil and gas development and would result in related impacts e.g., vessel traffic, noise, and accidental releases.

The most consequential impact on marine mammals from offshore minerals mining likely is the acoustic impacts from G&G surveys. Because these surveys do not require the same depth of penetration sought for oil and gas G&G surveys, airguns are not used. Side scan sonar uses frequencies above hearing range of cetaceans, manatees, and seals and generates pulses of <0.5 ms; sub-bottom profilers emit a chirping sound between 500 Hz - 24 kHz with pulses of <1 ms. Sand and gravel resources surveys also have a shorter duration than oil and gas G&G surveys, further reducing potential impacts to marine mammals.

Wind energy IPFs are not expected to interact materially with marine minerals mining, which is expected to have a negligible impact on marine mammals.

### *Marine transportation*

Marine transportation in the South Atlantic region is diverse, including cargo; tug/barge; liquid tanker; dredging; underwater/diving operations; military operations, training, and testing; scientific research; search-and-rescue vessels; and recreational traffic. Commercial and recreational fishing are discussed in detail as a separate element in the cumulative impact scenario on Chapter 3.7.

Vessel call volume remained relatively steady from 2006 to 2015, with no discernible trend, as illustrated in Table 3-17 for select ports and terminals in the South Atlantic AOI and in Figure 3-9 for the five busiest South Atlantic ports. However, USACE has identified the Southeast coast ports as top candidates for economically justified port expansion projects to improve ports capable of handling post-Panamax vessels. Port expansion would involve dredging deeper channels and increasing the size and capabilities of port equipment, e.g., larger winches and cranes and associated power upgrades. If this improvement occurs commercial ship traffic in the Southeast may see a future increase.

Reviewing the 20-year time series for total recreational fishing effort from 1998 to 2018 reveals a long-term increase in total offshore trips but with a dramatic crash from 2007 to 2014 that is most likely was caused by poor economic conditions during that period. The 20-year data appear to confirm gradual increases in recreational fishing effort from 1998 to 2007 and from 2013 to 2018. However, the recent 10-year trend shows sufficient variability that there is no clear increasing or decreasing trend in the South Atlantic. In sum recreational fishing trends show a static or possible modest increasing trend in vessel trips and a likely increase in vessel size.

However, although fewer calls suggest a potential lessening of the maritime shipping industry reduce noise generation from marine transportation, these larger ships may also create a greater acoustic profile that negates any decrease from less traffic.

IPFs that potentially interact with OCS wind energy development include port utilization, vessel traffic, and vessel noise, although the IPFs that are important to impacts on marine mammals are primarily vessel traffic and vessel noise. Vessel activity from wind energy leases near marine transportation routes may interact to increase overall noise in the vicinity of the WTGs but also from maintenance/emergency trips and G&G surveys. However, wind energy vessel activity is small portion of overall marine traffic. Interactions with G&G surveys have limited durations that reduces their potential interaction with marine transportation and impacts on the acoustic environment,

The level of activity of marine transportation is projected to remain at or about current levels. Vessel traffic and strikes from offshore wind energy development are expected to contribute little incremental addition for the existing, overall level of marine traffic and a commensurately negligible incremental impact on marine mammals.

### *Military use, military range complexes, civilian space programs*

The Navy represents a significant extensive military use of the coastal and offshore environment; NASA leads the civilian space program's use offshore Virginia, near the northern border of the South Atlantic AOI, and in the South Atlantic AOI offshore Cape Canaveral, Florida. Military use of coastal and offshore areas is not restricted to the Navy; the Coast Guard, Marines, Air Force, and Army all utilize these areas for operations, training, and testing.

The Navy released its Final EIS on its Atlantic fleet training and testing in September 2018 (Navy 2018). The Navy determined training and testing activities have the potential to expose marine biota to multiple acoustic stressors that could produce temporary or permanent hearing threshold shift, auditory masking, physiological stress, or behavioral responses. However, acoustic stressors are unlikely to incur substantive costs at the individual or populations level because Naval activities are widely distributed over the Atlantic coast and are intermittent. Thus, individual animals typically would experience a small number of behavioral responses or temporary hearing threshold shifts per year.

There is always substantial uncertainty in predicting the levels of military use of the range complexes in the future as world events unfold. In the near term, the level of military activity will likely remain relatively stable in the AOI, although fiscal trends are placing downward pressure on these activities. Civilian space program uses in the region may increase above the present level given the recent expansion of commercial interest in space.

**Table 4-12. 5-Year Take, Pile Driving, Marine Mammals, Atlantic Fleet from Naval Testing and Training Operations**

| Impact | Endangered whales | Non- endangered whales (9 spp.) | Dolphin (18 spp.) |
|---|---|---|---|
| Behavioral | 10 | 102 | 1,126 |
| TTS | 292 | 231 | 3,485 |
| PTS | 16 | 30 | 303 |
| Injury | 0 | 0 | 21 |
| Behavioral | 10 | 102 | 1,126 |
| TTS | 292 | 231 | 3,485 |
| PTS | 16 | 30 | 303 |
| Injury | 0 | 0 | 21 |

TTS: temporary threshold shift; PTS: permanent threshold shift
Source: Navy 2018

The Navy's Final EIS lists six direct stressors on marine mammals resulting from its testing and training activities: acoustics, explosions, energy, physical disturbance, entanglements, and ingestion (AFTT). The Navy's conclusions about impacts to marine mammals are summarized in Table 4-12 and include the following:

Acoustics. Because individual animals would typically only experience a small number of behavioral responses or temporary hearing threshold shifts per year from exposure to acoustic stressors and are unlikely to incur substantive costs to the individual, population level effects are unlikely.

Explosions. Because most estimated impacts from explosions are behavioral responses or temporary threshold shifts (TTS) and because the number of marine mammals potentially impacted by explosives are small compared to each species' respective abundance, population level effects are unlikely.

High energy lasers. Statistical probability analyses demonstrate with a high level of certainty that no marine mammals would be struck by a high-energy laser. Energy stressors associated with Navy training and testing activities are temporary and localized in nature and, based on patchy distribution of animals, no impacts to individual marine mammals and marine mammal populations are anticipated.

Physical disturbance. Historical data on Navy ship strike records demonstrate a low occurrence of interactions with marine mammals over the last 10 years. The Navy does not anticipate a change in the level of vessel use compared to the last decade; the potential for striking a marine mammal remains low. No recorded or reported instances of marine mammal strikes have resulted from in-water devices. Long-term consequences to marine mammal populations from physical disturbance and strike stressors associated with Navy training and testing activities are not anticipated.

Entanglement. Physical characteristics of wires and cables, decelerators/parachutes, and biodegradable polymers combined with the sparse distribution of these items throughout the AOI indicate a very low potential for marine mammals to encounter and become entangled in them. Long-term impacts to individual marine mammals and marine mammal populations from entanglement stressors associated with Navy training and testing activities are not anticipated.

Ingestion. The likelihood that a marine mammal would encounter and subsequently ingest a military expended item associated with Navy training and testing activities is considered low. Long-term consequences to marine mammal populations from ingestion stressors associated with Navy training and testing activities are not anticipated.

Offshore wind energy vessel traffic is expected to have little or no interaction military/civilian space operations or incremental impact with on marine mammals.

### *Oil and gas surveys and extraction*

The Atlantic has seen minimal oil and gas development interest and activity from the 1970s through the present: between 1979 and 1984 eight exploratory wells were drilled with no economically viable discoveries. The current five-year OCS oil and gas lease sale plan has no lease sales scheduled through 2022. Any projections for future leasing in the Atlantic would be speculative. Therefore, the cumulative impact scenario considers only the impacts of G&G activities. When leases sales are conducted, the full list of oil and gas development- related IPFs will need to be assessed. G&G survey activities are allowable in the region, though restrictions apply to some areas. BOEM has received several permit requests for G&G surveys in support of oil and gas exploration and industry has expressed interest in expanding activities on the Atlantic OCS (BOEM 2019e).

BOEM has extensively analyzed potential acoustic impacts of oil and gas G&G activity in the Mid- and South Atlantic regions (BOEM, 2014a). Sound sources used during G&G activities have the potential to produce stress, disturbance, and behavioral responses in marine mammals if they are present within the range of the operational array. Survey protocols and underwater noise mitigation procedures are implemented to decrease the potential for any marine mammal to be within the acoustic exclusion zone of an operating sound source and reduce the potential for behavioral responses and injury (PTS/TTS) close to the sound source. BOEM also considers the details of a proposed survey during the site/permit specific NEPA analysis to determine if there is an entrapment potential and, if so, mitigate to prevent it. BOEM's estimates for the Mid Atlantic would be higher than expected for the South Atlantic AOI due to the lower projected level of offshore wind energy development in the South Atlantic.

BOEM estimates for Potential Level A take using a 180-dB criterion for all airgun seismic survey types has been conservatively predicted for all listed marine mammal species except the West Indian manatee.

- Sperm whale (45-310 individuals per year; total: 977 individuals for the project duration);
- Humpback whale (2-12 individuals per year; total: 39 individuals for the project duration); and
- All other listed cetacean species (less than 9 individuals taken per year).

As a comparison, Level A incidental take estimates surveys using the Southall et al. (2007) criterion were predicted for all listed species except the fin whale. Estimated take is less than one individual per survey year (beginning in 2014) except for:

- Humpback whale (0.7-5.9 individuals),
- Blue whale (0.2-1.6 individuals), and
- Bryde's whale (0.1-1.2 individuals).

These Level A take estimates are meant to be highly conservative upper limits of take that do not consider the role of mitigation in reducing take with the exception of the time-area closure. They are not expected levels of actual take.

Estimates of total Level B take (160-dB criterion) were estimated for listed species; total estimated Level B take for all airgun seismic survey types has been conservatively predicted at levels of over 100 individuals per survey year (2014-2020) for all listed marine mammal species except the West Indian manatee. The species most affected were:

- Sperm whale 361-30,356 individuals per year during the survey period
- North Atlantic right whale during this period ranges from 60-224 individuals.

These analyses used the upper limit of potential take based on highly conservative modeled estimates, applied what is known about the likelihood of species in the action area reacting to seismic airgun noise, considered the range of responses from animals that may occur, and applied mitigation to eliminate/limit the potential for Level A harassment and reduce the potential for Level B harassment. The effects of seismic airgun survey noise on marine mammals within the AOI would be moderate. Most impacts would be limited to short-term disruption of acoustic habitat and behavioral patterns, abandonment of activities, or displacement of individual marine mammals from discrete areas within the AOI, including both critical and preferred habitats.

The IPFs related to G&G surveys relevant to marine mammals that may overlap with those of offshore wind energy primarily involve noise from seismic surveys, including airgun blasts; vessel noise, vessel traffic, and vessel strikes. The interaction of oil and gas extraction and wind energy development IPFs can be minimized by timing and location considerations. Seismic surveys can extend over a time scale of months, as does construction and installation of wind energy structures. However, identifying the locations and schedules of wind energy G&G and construction/installation activities and of oil and gas G&G activities could avoid overlapping noise and vessel strike impacts by scheduling activities to avoid cumulative impacts to marine mammals from both oil and gas and offshore wind energy development impacts.

### *Renewable energy development, wind*

Wind energy development is expected to continually increase in the foreseeable future along the entire Atlantic coast of the U.S. Currently, there is one operating wind energy facility, the Block Island Wind Farm BOEM currently has 15 active commercial leases and one active research lease offshore the East Coast of the U.S. The OCS-A 0508 lease for the Kitty Hawk, North Carolina Offshore Wind/Avangrid project, is in the South Atlantic AOI.

BOEM has changed its criteria for inclusion of projects in its cumulative impacts scenario as being reasonably foreseeable. BOEM now includes in its reasonably foreseeable future: all projects with COPs submitted or approved, with offtake awarded, or for which the developer has publicly announced plans of development; any additional development to fulfill the remaining, announced offshore wind solicitations; and he more likely of the remaining planned Atlantic state solicitations. Currently, these projects account for some 17GW in offshore wind energy production.

Wind energy development has the potential to produce impacts from site characterization studies (i.e., G&G surveys without airguns), site assessment data collection activities that involve installation of meteorological towers or buoys and installation and operation of turbine structures. The IPFs relevant to impacts on marine mammals are:

- *Site characterization surveys.* G&G survey IPFs include accidental releases; discharges, HRG (no airguns) surveys, and vessel traffic
- *Site assessment studies: installation of meteorological towers and/or buoys.* Site assessment studies have the same IPFs as G&G surveys except for noise from HRG surveys. In addition, site assessment related IPFs include construction/ installation impacts, seabed alterations, noise, port utilization; traffic; and presence of structures.

- *Installation/Decommissioning of turbine structures*. Installation of turbines will have all of the IPFs described for site assessment studies but also include impacts from scour protection, electromagnetic fields, energy generation, new cable emplacement, noise from O&M, decommissioning/structure removal noise and vessel traffic, and presence of structure impacts.

BOEM (2016b) released an extensive study on the acoustic sound fields associated with high-resolution marine geophysical (HRG) surveys. Acquiring data to characterize the acoustic fields radiated by marine geophysical acoustic survey systems was critical to understanding the potential impact of HRG surveys on marine life. The study was performed under interagency agreements between BOEM, USGS and the Naval Undersea Warfare Center Division Newport (NUWD-N), Naval Sea Systems Command. The study acquired and analyzed calibrated acoustic source data, including source levels, intensity spectra, and beam patterns for 18 commonly used marine geophysical survey systems that included boomers, sparkers, airguns, chirp profilers, side-scan sonars, and multibeam bathymetric echosounders.

BOEM (2014a) has estimated the distance to 180 dB and 160 dB acoustic thresholds from G&G survey equipment (see Table 4-13). Distances to these acoustic thresholds are on the order of less than ten meters to less than a kilometer. The IPFs of offshore wind energy development most consequential to marina mammals are noise and vessel traffic and associated vessel strikes. Among noise impacts, the most serious is that generated driving piles; noise from G&G surveys and vessels are other sources of lesser acoustic stress. BOEM (2014a) has estimated the distance to 180 dB and 160 dB acoustic thresholds from G&G survey equipment (see Table 4-13). Distances to these acoustic thresholds are on the order of less than ten meters to less than a kilometer.

**Table 4-13. Acoustic Thresholds from G&G Survey Equipment**

| Source | Max dB | Radial distance to 180 dB, m | Radial distance to 160 dB, m |
|---|---|---|---|
| Boomer | 212 | 5 | 16 |
| Side-scan sonar | 226 | 65 – 96 | 337 – 450 |
| CHIRP sub-bottom profiler | 222 | 26 – 35 | 240 – 689 |
| Multibeam depth sounder | 213 | <5 | 12 |

In contrast to potential impacts from wind energy development G&G surveys that projected maximum impacts of less than a kilometer, a study of wind turbine noise on harbor porpoises, bottlenose dolphins, harbor seals, and North Atlantic right whales indicated that pile-driving sounds are audible to marine mammals at ranges of more than 100 km. The frequency range for pile-driving sound overlaps with the hearing frequency for all marine mammals. Others have estimated audibility to all hearing groups ranging from 15 to 50 km.

BOEM concluded disturbance of marine mammals from underwater noise generated by site characterization and site assessment activities would likely result in temporary displacement and other behavioral or physiological consequences. NMFS concluded in its Biological Opinion that offshore wind energy development in the Mid and South Atlantic is likely to result in takes of North Atlantic right, humpback, fin, and sei whales in the form of harassment, when increased underwater noise will temporarily impair normal behaviors (NMFS 2014). This harassment will occur in the form of avoidance or displacement from preferred habitat and behavioral and/or metabolic compensations in response to short-term masking or stress. Because of the mitigation measures are expected to minimize potential effects to right whales and other marine mammals, BOEM expects no major impacts on marine mammals.

For OCS wind energy development in the South Atlantic AOI, BOEM currently has determined there is no reasonably foreseeable offshore wind development. Consequently, OCS wind energy development in the South Atlantic is not projected to impact any potentially affected resource nor interact with any actions or activities included in the cumulative impacts scenario.

### *Submarine cables, transmission/telecommunication lines, pipelines*

As of December 2012, NOAA charted three submarine telecommunications cables in the South Atlantic: two near Titusville, Florida and one near Jacksonville, Florida (Figure 3-19). Two additional fiberoptic cables were recently installed in 2014 and 2015; both make landfall near Jacksonville, Florida. Two cables originate in Virginia Beach and run along the North Carolina coast and through Pamlico Sound but make no landfall in North Carolina. Not all of these cables are necessarily utilized as the NOAA listings include both active and out of service cables.

Relatively speaking, there are few submarine cables in the South Atlantic as compared to the North and Mid-Atlantic. Submarine telecommunications cables are consistently being upgraded, enhanced, and expanded as circuit capacity is used up or current cables reach the end of their effective lifespan. Replacement and repair of existing cables are also ongoing and are expected to continue to do so in the foreseeable future. Thus, the expected trend for submarine cables is that activity will remain static or there may be a small increase in activity. There are six pending submarine cable installation applications with the FCC; none are located in the South Atlantic.

Submarine cables, lines, and pipeline IPFs relevant to marine mammals and may overlap with those of wind energy development include accidental releases; installation of new subsea cables; vessel discharges; electromagnetic fields; vessel and construction noise; vessel traffic; and vessel strikes. The IPFs of seabed cables, lines, and pipelines of note for marine mammals are primarily related to noise from construction/installation and vessels and vessel strikes. Impacts from construction will only be significant if pile driving is required to support needed infrastructure; impacts of pile driving have been discussed above. The level of vessel activity is relatively low and not expected to be a significant contributor to anticipated vessel traffic noise. The impact of submarine cable, lines, and pipelines is not expected to interact with relevant IPFs of offshore wind energy development to any material degree and is expected to be negligible for marine mammals.

### *Climate change*

As described in Section 3.8, climate change disrupts geophysical and biological resources around the world. Climate change may directly alter the impacts of IPFs such as increasing ambient sound due to more violent storms that masks communication and indirectly such as alterations of habitat and range due to changes in food source locations in response to changing ocean temperatures and current patterns. Wind energy development could have a beneficial impact on climate change to the extent its energy generation reduces energy generation from fossil fuels that would otherwise be used to meet power demands.

### *4.3.2.6 Sea Turtles*

**Table 4-14. Cumulative Impacts Scenario IPFs – Sea Turtles**

| | Dredge Material Ocean Disposal | Commercial and Recreational Fishing | Land Use /Coastal Infrastructure | Marine Minerals Extraction | Marine Transportation, Navigation, and Traffic | Military Ranges & Civilian Space Program Uses | Oil and Gas Surveys and Extraction | Renewable Energy-Wind | Submarine Cables, Lines, & Pipelines | Climate Change |
|---|---|---|---|---|---|---|---|---|---|---|
| **Offshore Wind Energy Development IPFs** | | | | | | | | | | |
| Accidental releases | ● | ● | ● | ● | ● | ● | ● | ● | ● | |
| Discharges | ● | ● | ● | ● | ● | ● | ● | ● | ● | |
| Electromagnetic fields | | | | | | | | ● | ● | ● |
| Energy generation, energy security | | | | | | | | ● | | ● |
| New cable emplacement/maintenance | | | | | | | | ● | ● | ● |
| Noise | ● | ● | ● | ● | ● | ● | ● | ● | ● | |
| Port utilization | ● | | | | ● | | ● | ● | | ● |
| Presence of structures | | | ● | | | ● | ● | ● | ● | ● |
| Traffic | ● | ● | ● | ● | ● | ● | ● | ● | ● | |
| **Cumulative Impact Scenario, Other IPFs** | | | | | | | | | | |
| Beach restoration | ● | | | ● | | | | | | ● |
| Bycatch | | ● | | | | | | | | |
| Demolition/structure removal | | | | | | ● | ● | | | |
| Energy stressors/devices/lasers | | | | | | ● | | | | |
| Gear utilization | | ● | | ● | | ● | | | | ● |
| Ingestion | | | | | | ● | | | | |
| Ocean acidification | | | | | | | | | | ● |
| Pipeline trenching | | | | | | | ● | | | |
| Resource exploitation | | ● | | | | | | | | ● |
| Warming and sea-level rise | | | | | | | | | | ● |

Of the six species of sea turtles found in offshore U.S. waters, only the Olive Ridley is found off the Pacific coast. The five species occur that occur in South Atlantic waters are Kemp's ridley, loggerhead, green, hawksbill, and leatherback turtles. All five species of sea turtle are listed as threatened or endangered. Kemp's ridley, hawksbill, and leatherback turtles are listed as endangered. Loggerheads are separated into nine distinct population segments (DPSs), and the South Atlantic DPS of this species is listed as threatened. Green sea turtles are separated into 11 DPS and the South Atlantic DPS of is listed as threatened (NOAA 2019j).

#### *Dredged material ocean disposal*

There are 8 active projects and 8 inactive/closed projects identified in the South Atlantic AOI (Table 3-10). Ocean disposal of dredge material has decreased as beneficial reuse has increased. USACE reported that about 20% to 30% of port and waterway dredged material is used for habitat creation and other beneficial uses (USACE 2012). With increased port expansion/dredging projects to handle post-Panamax vessels, BOEM expects ocean disposal activity to remain stable or increase.

The IPFs related to ocean disposal relevant to sea turtles that may interact with wind energy-related IPFs are primarily vessel-derived stressors and include accidental releases; discharges; noise; and vessel traffic and strikes. Important IPFs for sea turtles are noise and vessel strikes. Fuel spills and releases of trash and debris due to their low probability of occurrence and relatively limited spatial impact are expected to have lesser potential impact on sea turtles.

IPFs of ocean disposal have a low probability of interacting with those of offshore wind energy development unless the wind energy leases are located close to designated dump sites. Because the vessel traffic related to ocean disposal is an insignificant contributor to the overall vessel traffic in the North and Mid- Atlantic regions (some 3,300 disposal events over 40 years), its potential contribution to the regional noise and strike impacts on sea turtles is commensurately small and expected to be negligible.

### *Commercial and recreational fishing*

In 2017, commercial fisheries harvested approximately 194 million pounds of fish and shellfish in the four-state region (including North Carolina, South Carolina, Georgia and Florida), with a total landed value of over $397 million (2018 dollars); over the period from 2008 to 2017, average annual landings were 190 million pounds with a value of $376 million (NOAA 2019d).  The top five species by landing value in 2017 for the four-state region included for the four-state region included white shrimp, blue crab, Caribbean spiny lobster, pink shrimp, and stone crab (NOAA 2019d). Total values and pounds landed over the past ten years are shown in Figure 3-13, based on data from NOAA Fisheries. Between 2008 and 2017, the value of landings ranged from $305 million to $431 million, while landings weight ranged from 179 million pounds to 210 million pounds.

The IPFs of commercial and recreational fishing are primarily related to larger vessels used in commercial fishing. The IPFs that may interact with offshore wind energy development and contribute to the acoustic environment include noise related to vessel traffic and vessel operations e.g., noise related gear deployment, operations, and retrieval (especially bottom dredges). Vessel traffic from commercial and recreational fishing is a significant contributor to overall vessel traffic along the South Atlantic coast but are expected to remain stable for the foreseeable future. The potential effects of noise on fishes can be categorized in increasing order of severity as: behavioral responses; masking of biologically important sounds; temporal threshold shifts (hearing loss); physiological/ anatomical effects; and mortality.

A substantial impact of commercial fishing on sea turtles is the entrapment or entanglement that occurs with a variety of fishing gear. The impacts of bycatch on marine mammals that has been discussed previously is entirely appropriate to a discussion of the impacts of bycatch on sea turtles. Estimated average annual bycatch of loggerhead turtles in Mid-Atlantic bottom otter trawl gear during 1996-2004 was 616 animals (Murray 2006). Impacts from bycatch are a primary threat to sea turtles (NOAA 2018). A reduction in bycatch has been achieved by the requirement for the use of bycatch mitigation measures. A comparison pre- versus post-regulation mean annual bycatch data for Mid-Atlantic fisheries (otter trawl, gillnet, scallop trawl, scallop dredge, Virginia pound net) showed sea turtle bycatch was reduced from 2,400 incidents to 1,700 and mortality reduced from 1,000 to 470 based on data over the period 1990 to 2007 (Finkbeiner 2011).

The interaction between fisheries and offshore wind energy development extend primarily to vessel traffic, and the expected vessel traffic from wind energy development is far less than that of commercial and recreational fisheries and contributes little to the cumulative impacts of South Atlantic waters.

### *Land use and coastal infrastructure*

Land use on the South Atlantic coast is diverse, encompassing many distinct environments, supporting a wide range of ecosystems, and human activities including recreation, tourism, residential, commercial, and industrial infrastructures. The impact of wind energy development on land use requirements primarily relates to the increase in port activity required to meet the demands for fabrication, construction, transportation, installation, and maintenance of wind energy structures. Connections to the power grid also may impact local land use and development.

A DOE assessment report in 2014 used the Port of Morehead City, North Carolina as a case study to estimate the capacity for offshore wind development in the South Atlantic region in the next 10-20 years. The report concluded needed improvements were minimal and if made that one port such as Morehead City would be able to satisfy the port infrastructure requirements to support offshore wind capacity development in the region. That said, DOE also anticipated multiple staging ports would be utilized to minimize transit differences. Also, given the increasing size of offshore wind turbines there may be additional improvements required.

IPFs related to land use and coastal infrastructure that may interact with wind energy related IPFs and sea turtles include accidental releases; effluent discharges; land disturbance/development with habitat loss; noise; and vessel traffic and strikes. These impacts will be spatially limited to the area near port. The impacts of land use and coastal development will affect sea turtles primarily through habitat loss for development near sea turtle nesting areas. Land development for seaport size increase will be negligible as existing port infrastructure is sufficient to address offshore wind energy development needs. The incremental increase in vessel related IPFs from offshore wind development vessel activity is expected to be a minor contributor to overall port activity compared to commercial, industrial, and recreational inputs. However, baseline levels of vessel traffic and commerce at ports need to be considered for the specific port(s) used for a specific wind energy development project when assessing the significance of the incremental contribution of wind energy development to impacts on sea turtles.

Existing port infrastructure appears to be sufficient to address the requirements of offshore wind energy development, consequently little need for port expansion. Thus, the impact of offshore wind energy development on sea turtles will be negligible on sea turtles.

### *Marine minerals extraction*

Data on projected sand mining activity, based on current lease agreements, indicate a stable or slightly increasing trajectory through 2020. There are two active leases both of which are located offshore Brevard County, Florida and one lease request that is offshore Flagler County, Florida. There is currently one large (2.2 million cu yd) active lease located off Virginia Beach, Virginia. The lease is less than 50 km from the North Carolina border and could potentially interact with wind energy development activities in the northern areas offshore North Carolina.

States also have active minerals mining and channel dredging activities that support numerous local beach renourishment projects. However, the type and availability of data on these projects vary widely at the state and county level. The Army Corps of Engineers (USACE 2020).may have the most comprehensive source of information on these local projects at its USACE Jurisdictional Determinations and Permit Decisions website: https://permits.ops.usace.army.mil/orm-public.

Project-level dredging activities and wind energy construction and installation activities are typically relatively short-term efforts‒one or two years. However, dredging for a series of beach restoration projects is possible and could result in longer-term impacts. Thus, specific minerals mining projects need to be assessed if the wind energy lease is near active borrow sites. Marine minerals mining may also require G&G activities that are similar, although much less extensive, to wind energy G&G surveys and wind energy related impacts. These impacts on the acoustic environment are related to noise from both vessel traffic and operational noise e.g., HRG surveys. The interaction of minerals mining and wind energy G&G surveys will be temporally limited and could be scheduled to be avoided. These surveys can be spatially extensive, but they are of relatively short duration and could be scheduled to avoid overlapping impacts to the acoustic environment.

Vessel strikes and noise are important IPFs in evaluating minerals mining impacts on sea turtles. Because dredging vessel activity is a small contributor to overall marine traffic in the AOI, marine mining vessel traffic will have a negligible impact on sea turtles. Offshore wind energy development will have little or no interaction with minerals mining impacts on sea turtles.

### *Marine transportation*

Marine transportation in the South Atlantic region is diverse, including cargo; tug/barge; liquid tanker; dredging; underwater/diving operations; military operations, training, and testing; scientific research; search-and-rescue vessels; and recreational traffic. Commercial and recreational fishing are discussed in detail as a separate element in the cumulative impact scenario on Chapter 3.7.

Vessel call volume remained relatively steady from 2006 to 2015, with no discernible trend, as illustrated in Table 3-17 for select ports and terminals in the South Atlantic and in Figure 3-9 for the five busiest South Atlantic ports. However, USACE has identified the Southeast coast ports as top candidates for economically justified port expansion projects to improve ports capable of handling post-Panamax vessels. Port expansion would involve dredging deeper channels and increasing the size and capabilities of port equipment, e.g., larger winches and cranes and associated power upgrades. If this improvement occurs commercial ship traffic in the Southeast may see a future increase.

The 20-year time series for total recreational fishing effort from 1998 to 2018 shows a long-term increase in total offshore trips but with a dramatic crash from 2007 to 2014 that is most likely was caused by poor economic conditions during that period. The 20-year data appear to confirm gradual increases in recreational fishing effort from 1998 to 2007 and from 2013 to 2018. However, the recent 10-year trend shows sufficient variability that there is no clear increasing or decreasing trend in the South Atlantic. In sum recreational fishing trends show a static or possible modest increasing trend in vessel trips and a likely increase in vessel size.

IPFs that are important to impacts on sea turtles are primarily vessel traffic (strikes) and vessel noise. Vessel activity from wind energy leases near marine transportation routes may interact to increase overall noise in the vicinity of the WTGs but also from maintenance/emergency trips and G&G surveys. However, wind energy vessel activity is small portion of overall marine traffic. Interactions with G&G surveys have limited durations that reduces their potential interaction with marine transportation and impacts on the acoustic environment,

Noise related to wind energy construction could interact with marine vessel traffic but only to a limited temporal and spatial degree, also reducing potential acoustic impacts. Wind energy development could potentially impact shipping fairways, traffic lanes, and anchorage areas and increase noise near these areas, which already are subject to heavy marine traffic, or cause them to use other routes, bringing their acoustic impacts into new areas. This concern, however, should be addressed in the scoping and public comment phases of the offshore wind energy leasing process.

### *Military use, military range complexes, civilian space programs*

The Navy represents a significant extensive military use of the coastal and offshore environment; NASA leads the civilian space program's use offshore Virginia, near the northern border of the South Atlantic AOI, and in the South Atlantic AOI offshore Cape Canaveral, Florida. Military use of coastal and offshore areas is not restricted to the Navy; the Coast Guard, Marines, Air Force, and Army all utilize these areas for operations, training, and testing.

The Navy released its Final EIS on its Atlantic fleet training and testing in September 2018 (Navy 2018). The Navy determined training and testing activities have the potential to expose marine biota to multiple acoustic stressors that could produce temporary or permanent hearing threshold shift, auditory masking, physiological stress, or behavioral responses. However, acoustic stressors are unlikely to incur substantive costs at the individual or populations level because Naval activities are widely distributed over the Atlantic coast and are intermittent. Thus, individual animals typically would experience a small number of behavioral responses or temporary hearing threshold shifts per year.

There is always substantial uncertainty in predicting the levels of military use of the range complexes in the future as world events unfold. In the near term, the level of military activity will likely remain relatively stable in the AOI, although fiscal trends are placing downward pressure on these activities. Civilian space program uses in the region may increase above the present level given the recent expansion of commercial interest in space travel and privatization of previously government responsibilities.

The Navy released its Final EIS on its Atlantic fleet training and testing in September 2018 and assessed the impacts of six IPFs relevant to sea turtle impacts (Navy 2018).

Acoustics. Because the number of sea turtles potentially affected by sound-producing activities is small, although individual may be affected population-level effects are unlikely.

Explosives. Sea turtles would be exposed to explosive stressors in the nearshore and offshore portions of the Study Area. One loggerhead sea turtle mortality is predicted. Because the number of sea turtles potentially impacted by explosives is small, population-level effects are unlikely.

High energy lasers. Potential impacts from high-energy lasers would only result for sea turtles directly struck by the laser beam. Statistical probability analyses demonstrate with a high level of certainty that no sea turtles would be struck by a high-energy laser.

Physical disturbance and strikes. Vessels, in-water devices, and seafloor devices present a risk for collision with sea turtles, particularly in coastal areas where densities are higher. Strike potential by expended materials and debris is statistically small. Because of the low numbers of sea turtles potentially exposed to activities that may cause a physical disturbance and strike, although there is a possibility for individuals to sustain injury, population level effects are unlikely.

Entanglement. Sea turtles could be exposed to multiple entanglements from inshore and offshore training and testing locations. The potential for impacts is dependent on the physical properties of the expended materials and the likelihood that a sea turtle would encounter a potential entanglement stressor and become entangled. Physical characteristics of wires and cables, decelerators/parachutes, and biodegradable polymers combined with the sparse distribution of these items throughout the Study Area indicates a very low potential for sea turtles to encounter these materials. Long-term impacts on individual sea turtles and sea turtle populations from entanglement stressors associated with Navy training and testing activities are not anticipated.

Ingestion. Navy training and testing activities have the potential to expose sea turtles to multiple ingestion stressors and associated impacts from inshore and offshore training and testing locations Adverse impacts from ingestion of military expended materials would be limited to events where a sea turtle would be harmed from ingesting an item. The likelihood that a reptile would encounter and subsequently ingest a military expended item associated with Navy training and testing activities is considered low. Long-term consequences to reptile populations from ingestion stressors associated with Navy training and testing activities are not anticipated.

The Navy also produced an estimated take of sea turtles from sonar, explosives, and ship shock testing and training; no impacts from pile driving and air guns on sea turtles were expected.

**Table 4-15. Five-Year Take, Explosives and Ship Shock, Atlantic Fleet from Naval Testing and Training Operations**

| | Green turtle | Hawksbill turtle | Kemp's ridley turtle | Loggerhead turtle | Leatherback turtle | total |
|---|---|---|---|---|---|---|
| TTS | 96 | 8 | 84 | 1,722 | 763 | 2,673 |
| PTS | 17 | 0 | 22 | 268 | 42 | 349 |
| Injury | 0 | 0 | 1 | 49 | 5 | 55 |
| Mortality | 0 | 0 | 0 | 4 | 0 | 4 |

TTS: temporary threshold shift; PTS: permanent threshold shift
Source: Navy 2018

Sonar produced 38 instances of TTS impact. The impact of explosives and ship shock trials is shown in Table 4-15.

The interaction of IPFs of military activities with wind energy development IPFs is very unlikely because of the requirement to cease wind energy activities prior to commencement of naval testing or training exercises. Offshore wind energy is expected to have no impact on military use IPFs and impacts on sea turtles.

### *Oil and gas surveys and extraction*

The Atlantic has seen minimal oil and gas development interest and activity from the 1970s through the present: between 1979 and 1984 eight exploratory wells were drilled with no economically viable discoveries. The current five-year OCS oil and gas lease sale plan has no lease sales scheduled through 2022. Any projections for future leasing in the Atlantic would be speculative. Therefore, the cumulative impact scenario considers only the impacts of G&G activities. When leases sales are conducted, the full list of oil and gas development- related IPFs will need to be assessed.

G&G survey activities are allowable in the region, though restrictions apply to some areas. BOEM has received several permit requests for G&G surveys in support of oil and gas exploration and industry has expressed interest in expanding activities on the Atlantic OCS (BOEM 2019e). The IPFs of note related to G&G surveys that overlap with those of offshore wind energy development and may impact sea turtles include noise, vessel traffic, vessel strikes, and seismic surveys. BOEM concluded that impacts from airguns used in oil and gas G&G surveys on sea turtles. BOEM’s assessment of the impact of G&G activity in the Mid-Atlantic on sea turtles (BOEM 2014a) concluded:

- Depending on various factors, if surveys occur in nearshore areas breeding adults, nesting adult females, and hatchlings could be exposed to high levels of airgun seismic survey-related sound. Potential impacts could include auditory injuries to adults and dispersion of hatchlings, From this analysis, seismic airgun survey impacts on sea turtles would be expected to range from minor to moderate.
- Non-airgun HRG surveys are not likely to be detectable by sea turtles, and the effects from these sources on sea turtles are expected to be negligible.
- Noise from survey vessels may elicit behavioral changes such as evasive maneuvers that are not expected to adversely affect these individuals or the population; impacts would be negligible.
- The risk of vessel strikes on sea turtles is expected to be minimized because of strike avoidance guidelines, the typical slow speed of seismic vessels; and the use of observers; vessel strikes are expected to be avoided and vessel traffic-related impacts would be negligible.

The interaction of oil and gas extraction and wind energy development IPFs can be minimized by timing and location considerations. Seismic surveys can extend over a time scale of months, as does construction and installation of wind energy structures. However, identifying the locations and schedules of wind energy G&G and construction/installation activities and of oil and gas G&G activities could avoid overlapping impacts by scheduling activities to avoid cumulative impacts to sea turtles

### *Renewable energy development, wind*

Wind energy development is expected to continually increase in the foreseeable future along the entire Atlantic coast of the U.S. Currently, there is one operating wind energy facility, the Block Island Wind Farm BOEM currently has 15 active commercial leases and one active research lease offshore the East Coast of the U.S. The OCS-A 0508 lease for the Kitty Hawk, North Carolina Offshore Wind/Avangrid project, is in the South Atlantic AOI.

BOEM has changed its criteria for inclusion of projects in its cumulative impacts scenario as being reasonably foreseeable.

BOEM now includes in its reasonably foreseeable future: all projects with COPs submitted or approved, with offtake awarded, or for which the developer has publicly announced plans of development; any additional development to fulfill the remaining, announced offshore wind solicitations; and he more likely of the remaining planned Atlantic state solicitations. Currently, these projects account for some 17GW in offshore wind energy production.

Wind energy development has the potential to produce impacts from site characterization studies (i.e., G&G surveys without airguns), site assessment data collection activities that involve installation of meteorological towers or buoys and installation and operation of turbine structures. The IPFs relevant to impacts on the acoustic environment.

Wind energy development has the potential to produce impacts from site characterization studies (i.e., G&G surveys without airguns), site assessment data collection activities that involve installation of meteorological towers or buoys and installation and operation of turbine structures. The IPFs relevant to impacts on the birds and bats environment are:

- *Site characterization surveys.* G&G survey IPFs include accidental releases; discharges, HRG (no airguns) surveys, and vessel traffic
- *Site assessment studies: installation of meteorological towers and/or buoys.* Site assessment studies have the same IPFs as G&G surveys except for noise from HRG surveys. In addition, site assessment related IPFs include construction/ installation impacts, seabed alterations, noise, port utilization; traffic; and presence of structures.
- *Installation/Decommissioning of turbine structures*. Installation of turbines will have all the IPFs described for site assessment studies but also include impacts from scour protection, electromagnetic fields, energy generation, new cable emplacement, noise from O&M, decommissioning/structure removal noise and vessel traffic, and presence of structures.

The effects on sea turtles, specifically leatherback, loggerhead, Kemp's ridley, and green sea turtles, are expected to be short term and would result in minimal to negligible harassment depending on the specific activity. Harassment from noise, minor loss/displacement from forage areas, and to a lesser degree, vessel collisions, are the primary anticipated impacts to ESA-listed sea turtles; but these impacts, if any, are anticipated to be short-term and minimal. During pile driving, sound levels would have dissipated to below the 160 dB threshold within a distance of 7 km. Sea turtles within 7 km would be exposed to potentially injurious or harassing levels of sound. However, changes to individual's movements are expected to be minor and short-term, and are therefore, not likely to have population-level impacts.

This conclusion is supported by the NMFS (NMFS, 2011c). NMFS also concluded that the proposed lease issuance, associated site characterization, and subsequent site assessment activities are not likely to adversely affect listed sea turtles, when implemented according to the project design criteria and the conditions outlined in this assessment.

For OCS wind energy development in the South Atlantic, BOEM currently has determined there are no reasonably foreseeable offshore wind development. Consequently, OCS wind energy development in the South Atlantic is not projected to impact any potentially affected resource nor interact with any actions or activities included in the cumulative impacts scenario.

### *Submarine cables, transmission/telecommunication lines, pipelines*

As of December 2012, NOAA charted three submarine telecommunications cables in the South Atlantic: two near Titusville, Florida and one near Jacksonville, Florida (Figure 3-19). Two additional fiberoptic cables were recently installed in 2014 and 2015; both make landfall near Jacksonville, Florida. Two cables originate in Virginia Beach and run along the North Carolina coast and through Pamlico Sound but make no landfall in North Carolina. Not all these cables are necessarily utilized as the NOAA listings include both active and out of service cables.

Relatively speaking, there are few submarine cables in the South Atlantic as compared to the North and Mid-Atlantic. Submarine telecommunications cables are consistently being upgraded, enhanced, and expanded as circuit capacity is used up or current cables reach the end of their effective lifespan. Replacement and repair of existing cables are also ongoing and are expected to continue to do so in the foreseeable future. Thus, the expected trend for submarine cables is that activity will remain static or there may be a small increase in activity. There are six pending submarine cable installation applications with the FCC; none are located in the South Atlantic.

Submarine cables, lines, and pipeline IPFs that may overlap with those of wind energy development and sea turtles include: accidental releases; installation of new subsea cables; vessel discharges; electromagnetic fields; vessel and construction noise; presence of structures, e.g., offshore and onshore new cable infrastructure; and vessel traffic and vessel strikes.

Future seabed cable, line, and pipeline activity appears to be dynamic and has the potential to interact with wind energy IPFs. Most of this activity appears to be located close to shore. Kitty Hawk Wind, the ongoing wind energy development project off the Outer Banks in North Carolina is examining a potential cable line that would make landfall south of Virginia Beach. The cable route would run from the north-east end of the South Atlantic AOI northwest to shore. Virginia has extensive loggerhead nesting areas that require consideration in planning the cable landfall. The level of vessel activity from submarine cable emplacement is relatively low; impacts from presence of structures are spatially localized. The construction/installation related activity will involve vessel traffic, noise, and sediment resuspension that may impact sea turtles.

These activities will be of a relatively short duration. Vessel strike avoidance protocols may be considered depending upon the frequency of sea turtle sightings or stranding near project locations. Wind energy development IPFs clearly overlap with these general public and private subsea cable, line, and pipeline activities from the need to bring offshore power to the onshore distribution grid. Coordination among local, state, federal, and public and private sector stakeholders may be needed to avoid potential site or resource conflicts.

### *Climate change*

Climate change disrupts geophysical and biological resources globally (see Section 3.8). Climate change may directly alter the impacts of IPFs such as increasing ambient sound due to more violent storms that masks communications. Climate change may indirectly alter the impacts of IPFs that affect sea turtles in several ways. Warming may alter current nesting habitat suitability or stability; it also may alter availability/location of food sources, requiring sea turtle adaptations or population redistribution. Rising sea levels can have an even greater impact on nesting habitat. More intense and frequent storm events can affect habitat and may have acoustic impacts such as masking communications. Wind energy development could have a beneficial impact on climate change to the extent its energy generation reduces energy generation from fossil fuels that would otherwise be used to meet power demands.

### *4.3.2.7 Areas of Special Concern*

**Table 4-16. Cumulative Impacts Scenario IPFs – Areas of Special Concern**

| | Dredge Material Ocean Disposal | Commercial and Recreational Fishing | Land Use /Coastal Infrastructure | Marine Minerals Extraction | Marine Transportation, Navigation, and Traffic | Military Ranges & Civilian Space Program Uses | Oil and Gas Surveys and Extraction | Renewable Energy-Wind | Submarine Cables, Lines, & Pipelines | Climate Change |
|---|---|---|---|---|---|---|---|---|---|---|
| **Offshore Wind Energy Development IPFs** | | | | | | | | | | |
| Accidental releases | ● | ● | ● | ● | ● | ● | ● | ● | ● | |
| Air emissions | ● | ● | ● | | ● | ● | ● | ● | ● | |
| Anchoring | | | | | | ● | ● | ● | | |
| Discharges | ● | ● | ● | ● | ● | ● | ● | ● | ● | |
| Energy generation, energy security | | | | | | | | ● | | ● |
| Light | | ● | ● | | ● | ● | ● | ● | | |
| New cable emplacement/maintenance | | | | | | | | ● | ● | ● |
| Noise | ● | ● | ● | ● | ● | ● | ● | ● | ● | |
| Port utilization | ● | | | | ● | | ● | ● | | ● |
| Presence of structures | | | ● | | | ● | ● | ● | ● | ● |
| Traffic | ● | ● | ● | ● | ● | ● | ● | ● | ● | |
| **Cumulative Impact Scenario, Non-wind Energy IPFs** | | | | | | | | | | |
| Beach restoration | ● | | | ● | | | | | | ● |
| Gear utilization | | ● | | ● | | ● | | | | ● |
| Land disturbance | | | ● | | | | ● | | | ● |
| Ocean acidification | | | | | | | | | | ● |
| Pipeline trenching | | | | | | | ● | | | |
| Regulated fishing effort | | ● | | | | | | | | ● |
| Resource exploitation | | ● | | | | | | | | ● |
| Sediment deposition and burial | ● | | | | | | | | | ● |
| Seabed profile alterations | | | | ● | | | | | | ● |
| Warming and sea-level rise | | | | | | | | | | ● |

Areas of special concern include a variety of marine protected areas, including national marine sanctuaries (NMS), deepwater protected areas, national seashores (NSS), national wildlife refuges (NWR), and state-designated areas.

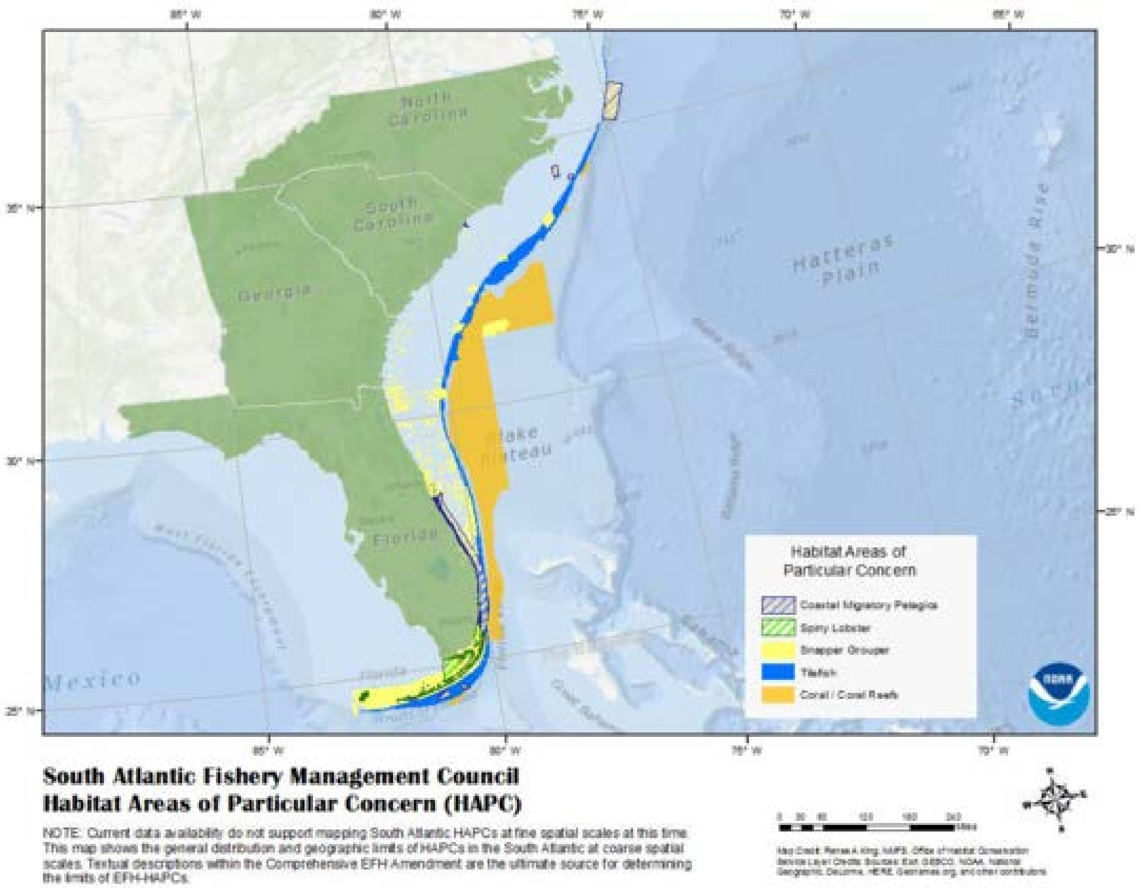
The South Atlantic coastal states are home to 21 NWRs. There are six NWRs in North Carolina: Mackay Island, Currituck, Pea Island, Pocosin Lake, Swanquarter, Cedar Island; five NWRs in South Carolina: Waccamaw. Cape Romain, Basin, Pinckney Island, Tybee; five NWRs in Georgia: Savannah, Wassaw, Harris Neck, Blackbeard Island, Wolf Island; and five NWRs in Florida: Merritt Island, St Johns, Archie Carr, Pelican Island, and Hobe Sound.

There are four NSS along the South Atlantic, two in North Carolina (Cape Hatteras and Cape Lookout NSSs); Cumberland Island NSS in Georgia; and Canaveral NSS in Florida. There are marine sanctuaries offshore North Carolina (Monitor NMS) and offshore Georgia Gray's Reef NMS.

There also are some 26 state-designated beaches and coastal parks within the South Atlantic AOI. Eight coastal state parks are in North Carolina; four are in South Carolina; five are in Georgia; and nine are in Florida.

In addition, NOAA has designated Habitat Areas of Particular Concern (HAPCs) within NOAA's designated EFH areas. Under the Magnuson-Stevens Act EFH is defined as waters and substrate necessary for fish spawning, breeding, feeding, or growth to maturity. The term Habitat Areas of Particular Concern pre-dates the Magnuson-Stevens Act, but are now defined as subsets of EFH that exhibit one or more of the following traits: rare, stressed by development, provide important ecological functions for federally managed species, or are especially vulnerable to anthropogenic degradation. They cover both specific locations (e.g., a bank, ledge, or spawning location) or habitat found at many locations (e.g., coral, nearshore nursery areas, or pupping grounds). There are extensive HAPCs in the South Atlantic (Figure 4-1; NOAA, 2018g).

**Figure 4-1. Habitat Areas of Particular Concern in the South Atlantic**




Source: NOAA 2018g

### *Dredged material ocean disposal*

There are 8 active projects and 8 inactive/closed projects identified in the South Atlantic AOI (Table 3-10). Ocean disposal of dredge material has decreased as beneficial reuse has increased. USACE reported that about 20% to 30% of port and waterway dredged material is used for habitat creation and other beneficial uses (USACE 2012). With increased port expansion/dredging projects to handle post-Panamax vessels, BOEM expects ocean disposal activity to remain stable or increase.

The IPFs of ocean disposal relevant to areas of special concern that may interact with wind energy-related IPFs include accidental releases; air emissions; vessel discharges; noise; and vessel traffic. Seafloor and benthic impacts from vessel anchoring and installation of pilings for wind energy structures could potentially interact with disposal activities but only if located near disposal sites and thus overall have a low probability of interacting with ocean disposal benthic impacts.

Vessel traffic and vessel related IPFs are the most likely IPFs that could potentially affect these areas of special concern. However, the potential for impact is primarily limited to vessel transits to and from ports. Due to the location of these areas of special concern at the coastline, potential impacts from dredge material ocean disposal are expected to be negligible.

### *Commercial and recreational fishing*

In 2017, commercial fisheries harvested approximately 194 million pounds of fish and shellfish in the four-state region (including North Carolina, South Carolina, Georgia and Florida), with a total landed value of over $397 million (2018 dollars); over the period from 2008 to 2017, average annual landings were 190 million pounds with a value of $376 million (NOAA 2019d). The top five species by landing value in 2017 for the four-state region included for the four-state region included white shrimp, blue crab, Caribbean spiny lobster, pink shrimp, and stone crab (NOAA 2019d). Total values and pounds landed over the past ten years are shown in Figure 3-11, based on data from NOAA Fisheries. Between 2008 and 2017, the value of landings ranged from $305 million to $431 million, while landings weight ranged from 179 million pounds to 210 million pounds.

The IPFs of commercial and recreational fishing relevant to areas of special concern that may interact with offshore wind energy development are accidental releases; waste discharges; noise; and vessel traffic. Vessel traffic from commercial and recreational fishing is a significant contributor to overall vessel traffic along the South Atlantic coast but is expected to remain stable or show a modest increase for the foreseeable future.

Potential impacts to areas of special concern are expected to be low as most fishing occurs farther offshore; commercial and recreational fishing near these areas have been compatible with areas of special concern and the future activity is expected to remain stable or decrease. Thus, impacts to areas of special concern from commercial and recreational fishing are expected to be negligible.

### *Land use and coastal infrastructure*

Land use on the South Atlantic coast is diverse, encompassing many distinct environments, supporting a wide range of ecosystems, and human activities including recreation, tourism, residential, commercial, and industrial infrastructures. The impact of wind energy development on land use requirements primarily relates to the increase in port activity required to meet the demands for fabrication, construction, transportation, installation, and maintenance of wind energy structures. Connections to the power grid also may impact local land use and development.

A DOE assessment report in 2014 used the Port of Morehead City, North Carolina as a case study to estimate the capacity for offshore wind development in the South Atlantic region in the next 10-20 years (DOE 2014). The report concluded needed improvements were minimal and if made that one port such as Morehead City would be able to satisfy the port infrastructure requirements to support offshore wind capacity development in the region. That said, DOE also anticipated multiple staging ports would be utilized to minimize transit differences. Also, given the increasing size of offshore wind turbines there may be additional improvements required.

The impact of wind energy development on land use requirements primarily relates to the increase in port activity required to meet the demands for fabrication, construction, transportation and installation of wind energy structures. This includes site assessment and characterization studies through turbine and distribution platform installation; seabed transmission line emplacement; and onshore substation connections.

The IPFs of land use and coastal infrastructure relevant to areas of special concern that may interact with wind energy related IPFs include accidental releases, air emissions, waste discharges, land disturbance/ development with habitat loss, noise, viewshed, and traffic. These impacts will be spatially limited to areas near ports except possibly exception of viewshed impacts. Port activity is not expected to require much expansion, and that will largely be in response to the need to handle larger ships. Residential and commercial coastal development can exert pressure on these areas, which in large part have been established to limit coastal development and preserve valuable ecological habitat. The impacts of land use and coastal infrastructure are expected to be negligible.

### *Marine minerals extraction*

Data on projected sand mining activity, based on current lease agreements, indicate a stable or slightly increasing trajectory through 2020. There are two active leases both of which are located offshore Brevard County, Florida and one lease request that is offshore Flagler County, Florida. There is currently one large (2.2 million cu yd) active lease located off Virginia Beach, Virginia. The lease is less than 50 km from the North Carolina border and could potentially interact with wind energy development activities in the northern areas offshore North Carolina.

States also have active minerals mining and channel dredging activities that support numerous local beach renourishment projects. However, the type and availability of data on these projects vary widely at the state and county level. Evaluating the potential interactions with offshore wind energy development and such local projects appears to require real-time effort at state- and county-level offices. The Army Corps of Engineers (USACE 2020).may have the most comprehensive source of information on these local projects at its USACE Jurisdictional Determinations and Permit Decisions website: https://permits.ops.usace.army.mil/orm-public.

IPFs that may overlap with wind energy IPFs include accidental releases; air emissions and discharges from vessels; noise; and vessel traffic. Marine minerals mining activities projects also may require geophysical and geotechnical survey activities similar to oil and gas development and related impacts e.g., vessel activity, noise, air emissions, spills.

Marine minerals mining IPFs potentially relevant to areas of special concern may interact with wind energy IPFs under limited spatial and temporal conditions. Project-level dredging activities and wind energy construction and installation activities are typically relatively short-term efforts−one or two years−and impacts arising from seafloor disturbances from either activity are relatively localized in their spatial extent. However, the likelihood of dredging for a series of beach restoration projects is possible and could result in longer-term impacts; the expected low levels of dredging need to be reviewed in the event natural or anthropogenic actions alter current projections. Because of the distance from shore to these borrow areas, direct impacts from sand and gravel mining have little likelihood of affecting areas of special concern. However, the potential for impact is primarily limited to vessel transits to and from ports. Potential impacts from marine minerals mining are expected to be negligible.

### *Marine transportation*

Marine transportation in the South Atlantic region is diverse and includes cargo; tug/barge; liquid tanker; dredging; underwater/diving operations; military operations, training, and testing; scientific research; search-and-rescue vessels; and recreational traffic. Commercial and recreational fishing are discussed in detail as a separate element in the cumulative impact scenario on Chapter 3.7.

Vessel call volume remained relatively steady from 2006 to 2015, with no discernible trend, as illustrated in Table 3-17 for select ports and terminals in the South Atlantic and in Figure 3-9 for the five busiest South Atlantic ports. However, USACE has identified the Southeast coast ports as top candidates for economically justified port expansion projects to improve ports capable of handling post-Panamax vessels. Port expansion would involve dredging deeper channels and increasing the size and capabilities of port equipment, e.g., larger winches and cranes and associated power upgrades. If this improvement occurs commercial ship traffic in the Southeast may see a future increase.

Reviewing the 20-year time series for total recreational fishing effort from 1998 to 2018 shows a long-term increase in total offshore trips but with a dramatic crash from 2007 to 2014 that is most likely was caused by poor economic conditions during that period. The 20-year data appear to confirm gradual increases in recreational fishing effort from 1998 to 2007 and from 2013 to 2018. However, the recent 10-year trend shows sufficient variability that the trend indicates no clear increasing or decreasing trend in the South Atlantic. In sum, recreational fishing trends show a static or possible modest increasing trend in vessel trips and a likely increase in vessel size. Although fewer calls suggest a potential lessening of the maritime shipping industry reduce noise generation from marine transportation, these larger ships may also create a greater acoustic profile that negates any decrease from less traffic.

IPFs that potentially interact with OCS wind energy development areas of special concern tend to be local e.g., port utilization and presence of structures/visual impacts. Port utilization is not likely to increase significantly as maritime activity is expected to remain at or near current levels. Visual impacts and maintaining the quality of areas of special concern will undoubtedly be an issue raised during the public discourse of the NEPA review process and mitigate potential impacts.

### Military use, military range complexes, civilian space programs

The Navy represents a significant extensive military use of the coastal and offshore environment; NASA leads the civilian space program's use offshore Virginia, near the northern border of the South Atlantic AOI, and in the South Atlantic AOI offshore Cape Canaveral, Florida. Military use of coastal and offshore areas is not restricted to the Navy; the Coast Guard, Marines, Air Force, and Army all utilize these areas for operations, training, and testing.

In the near term, the level of military activity will likely remain relatively stable in the AOI. However, fiscal trends are placing pressure on sustaining resources for instrumentation, range operation, and manpower. There is always substantial uncertainty in predicting the levels of military use of the range complexes in the future as world events unfold. Civilian space program uses in the region may increase above the present level, given the recent expansion of operations at Wallops Flight Facility and interest in commercial applications of space technology. Future cumulative impact scenarios should confirm there has been no significant change in the expected stable level of military and civilian space uses.

IPFs of military and civilian space uses that are relevant to areas of special concern that could overlap with those of wind energy development include accidental releases; air emissions; construction/installation impacts from vessels and anchoring buoys and structures, installing pilings, and dredging; discharges from vessels; mortality of fauna in range of target structures; and vessel traffic.

The Navy released its Final EIS on its Atlantic fleet training and testing in September 2018. Training exercises that occur in nearshore coastal areas have the greatest potential for impacts on areas of special concern. Air quality impacts were considered the most significant potential impact. However, due to the relatively brief duration of these exercises, and the attainment status of potentially affected areas, impacts to these nearshore areas would not create any violation of air quality standards.

### Oil and gas surveys and extraction

The Atlantic has seen minimal oil and gas development interest and activity from the 1970s through the present. The current five-year OCS oil and gas lease sale plan has no lease sales scheduled through 2022. Any projections for future leasing in the Atlantic would be speculative. Therefore, the cumulative impact scenario considers only the impacts of G&G activities. When leases sales are conducted, the full list of oil and gas development- related IPFs will need to be assessed.

G&G survey activities are allowable in the region, though restrictions apply to some areas. BOEM has received several permit requests for G&G surveys in support of oil and gas exploration and industry has expressed interest in expanding activities on the Atlantic OCS (BOEM 2019e). The IPFs of note related to G&G surveys that overlap with those of offshore wind energy development include noise and vessel traffic: noise from seismic surveys (e.g., airgun blasts), vessel noise, vessel traffic (including vessel strikes), and noise from pile driving and other construction noise. The interaction of oil and gas extraction and wind energy development IPFs can be reduced by timing and location considerations. Identifying the locations and schedules of wind energy G&G and construction/installation activities and comparing them to oil and gas G&G activities could avoid overlapping impacts through appropriate scheduling to avoid cumulative impacts to the acoustic environment, particularly when considering impacts to migrating species. Because of their distance from shore, these surveys are very unlikely to impact areas of special concern and are expected to be negligible.

### *Renewable energy development, wind*

Wind energy development is expected to continually increase in the foreseeable future along the entire Atlantic coast of the U.S. Currently, there is one operating wind energy facility, the Block Island Wind Farm BOEM currently has 15 active commercial leases and one active research lease offshore the East Coast of the U.S. The OCS-A 0508 lease for the Kitty Hawk, North Carolina Offshore Wind/Avangrid project, is in the South Atlantic AOI.

BOEM has changed its criteria for inclusion of projects in its cumulative impacts scenario as being reasonably foreseeable.

BOEM now includes in its reasonably foreseeable future: all projects with COPs submitted or approved, with offtake awarded, or for which the developer has publicly announced plans of development; any additional development to fulfill the remaining, announced offshore wind solicitations; and he more likely of the remaining planned Atlantic state solicitations. Currently, these projects account for some 17GW in offshore wind energy production.

Wind energy development has the potential to produce impacts from site characterization studies (i.e., G&G surveys without airguns), site assessment data collection activities that involve installation of meteorological towers or buoys and installation and operation of turbine structures. The IPFs relevant to impacts on the acoustic environment.

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- *Site characterization surveys***.** G&G surveys IPFs include accidental releases; air emissions and discharges from vessels; noise from vessels and HRG surveys; and vessel traffic and vessel strikes.
- *Site assessment studies: installation of meteorological towers and/or buoys***.** Site assessment studies have the same IPFs as G&G surveys with the exception of HRG surveys. In addition, site assessment-related IPFs include: air emissions from offshore installation of pilings and towers or buoys and from onshore fabrication of structures; discharges from onshore fabrication of structures; construction/installation impacts and seabed alterations from anchoring, driving pilings, and setting foundations for buoys; noise from driving pilings and setting of buoys; port utilization and traffic; impacts from presence of structures; and viewshed impacts.
- *Installation/Decommissioning of turbine structures***.** Installation of turbines will have all of the IPFs described for site assessment studies but also include air emissions from generators; impacts from scour protection; new cable emplacement; noise from O&M; and decommissioning/structure removal noise and vessel traffic.

Because of the distance from shore, wind energy impacts to areas of special concern are expected to be limited. Vessel transits to and from port and related impacts, e.g., air emissions, noise, discharges, will be localized to navigation routes and port activity. Visual impacts could occur if turbine structures are sufficiently tall and/or close to shore and require extra consideration if located within the viewshed of these shoreline, barrier island, or nearshore coastal island areas of special concern.

For OCS wind energy development in the South Atlantic, BOEM currently has determined there are no reasonably foreseeable offshore wind development. Consequently, OCS wind energy development in the South Atlantic is not projected to impact any potentially affected resource nor interact with any actions or activities included in the cumulative impacts scenario.

### *Submarine cables, transmission/telecommunication lines, pipelines*

As of December 2012, NOAA charted three submarine telecommunications cables in the South Atlantic: two near Titusville, Florida and one near Jacksonville, Florida (Figure 3-19). Two additional fiberoptic cables were recently installed in 2014 and 2015; both make landfall near Jacksonville, Florida. Two cables originate in Virginia Beach and run along the North Carolina coast and through Pamlico Sound but make no landfall in North Carolina. Not all of these cables are necessarily utilized as the NOAA listings include both active and out of service cables.

Relatively speaking, there are few submarine cables in the South Atlantic as compared to the North and Mid-Atlantic. Submarine telecommunications cables are consistently being upgraded, enhanced, and expanded as circuit capacity is used up or current cables reach the end of their effective lifespan. Replacement and repair of existing cables are also ongoing and are expected to continue to do so in the foreseeable future. Thus, the expected trend for submarine cables is that activity will remain static or there may be a small increase in activity. There are six pending submarine cable installation applications with the FCC; none are located in the South Atlantic.

Submarine cables, lines, and pipeline IPFs relevant to areas of special concern that may overlap with those of wind energy development include: accidental releases; air emissions from vessels; installation of new subsea cables; vessel discharges; vessel and construction noise; presence of structure impacts such as offshore and onshore new cable infrastructure; onshore space use conflicts; and vessel traffic.

Future seabed cable, line, and pipeline activity appears to be dynamic and has the potential to interact with wind energy IPFs. Although most of this activity appears to be located close to shore, a review of future applications should include consideration of the routes and locations of transmission lines and onshore connections reviewed in relation to areas of special concern. The level of vessel activity related to submarine cables, lines, and pipelines is relatively low and the construction/installation phase of the cables, lines, or pipelines is when the most significant impacts are likely to occur and are of limited duration. Impacts from presence of related structures are local and can be sited to avoid areas of special concern or mitigation measures implemented. Impacts from submarine cable, telecommunications, and pipelines on areas of special concern are expected to be negligible.

### *Climate change*

As described in Section 3.8, climate change disrupts geophysical and biological resources around the world. Climate change will directly or indirectly alter the impacts of IPFs that affect areas of special concern by warming and altering habitat. To the degree wind energy development offsets the use of fossil fuel used to generate power, it will reduce carbon emissions and further efforts to reduce global warming.

### 4.3.3 Socioeconomic and Cultural Resources

There is only one active wind energy lease in the area along the Atlantic coast from North Carolina to Florida (Avangrid's Kitty Hawk wind farm off the coast of North Carolina and Virginia). Given the current status of this effort, BOEM does not consider this project reasonably foreseeable for purposes of defining the cumulative impacts scenario related to wind development (see Section 3.1). Regardless, this section presents the potential IPFs associated with the various socioeconomic and cultural resources, as well as the potential for cumulative impacts associated with each activity on these socioeconomic and cultural resources.

#### *4.3.3.1 Demographics, Employment, Economics, and Environmental Justice*

**Table 4-17. Cumulative Impacts Scenario IPFs – Demographics, Employment, Economics, and Environmental Justice**

| | Dredge Material Ocean Disposal | Commercial and Recreational Fishing | Land Use /Coastal Infrastructure | Marine Minerals Extraction | Marine Transportation, Navigation, and Traffic | Military Ranges & Civilian Space Program Uses | Oil and Gas Surveys and Extraction | Renewable Energy-Wind | Submarine Cables, Lines, & Pipelines | Climate Change |
|---|---|---|---|---|---|---|---|---|---|---|
| **Offshore Wind Energy Development IPFs** | | | | | | | | | | |
| Air emissions | ● | ● | ● | | ● | ● | ● | ● | ● | |
| Energy generation, energy security | | | | | | | | ● | | ● |
| Light | | ● | ● | | ● | ● | ● | ● | | |
| Noise | ● | ● | ● | ● | ● | ● | ● | ● | ● | |
| Port utilization | ● | | | | ● | | ● | ● | | ● |
| Presence of structures | | | ● | | | ● | ● | ● | ● | ● |
| Traffic | ● | ● | ● | ● | ● | ● | ● | ● | ● | |
| **Cumulative Impact Scenario, Other IPFs** | | | | | | | | | | |
| Beach restoration | ● | | | ● | | | | | | ● |
| Demolition/structure removal | | | | | | ● | ● | | | |
| Land disturbance | | | ● | | | | ● | | | ● |
| Ocean acidification | | | | | | | | | | ● |
| Regulated fishing effort | | ● | | | | | | | | ● |
| Resource exploitation | | ● | | | | | | | | ● |
| Warming and sea-level rise | | | | | | | | | | ● |

The coastal zone from North Carolina to Florida is a large population hub with diverse populations and economies. Waterborne commerce, as well as tourism and port infrastructure are important components of many coastal economies. As highlighted in the table above, myriad activities have the potential to contribute to cumulative impacts on socioeconomic resources such as demographics, employment, public services, and property values. Actions occurring offshore could result in additional employment related to offshore and onshore construction activity, increased port utilization as well as vessel traffic and associated support. Cumulative impacts of alternative energy facilities on employment and income would depend on the number of people employed during construction and operations, the size of the populations in the areas where facilities were sited, and whether jobs would be able to utilize existing capacity in the local workforce. Since many coastal communities already support port infrastructure and activity the available capacity in the local workforce and marine crews with the required skillset for potential activities will determine the related demographic and employment impacts. Also, the duration and scale of offshore activities would determine the level of impacts to employment.

Several recent studies discuss the potential for creation of high-paying and sustained local jobs as a result of offshore wind development (NREL 2015). These jobs may be particularly important if they are created in areas that have experienced economic declines such as many industrialized coastal areas. Employment and regional economic impacts of wind energy development projects can be calculated using the Offshore Wind Jobs and Economic Development Impact (JEDI) model developed by the National Renewable Energy Labs (NREL). Given information on a project location, construction start year, nameplate capacity, and turbine size (if available), JEDI can provide information on construction phase and operating phase impacts, including local labor impacts, local revenue, and supply chain and induced impacts.

Cumulative impacts to demographics (e.g. population size, population growth, age, and racial distributions) are unlikely from temporary activities such as construction (BOEM 2016c). Numerous activities in the same geographic region could result in larger numbers of jobs but the numbers would likely still be small relative to the overall economy and population (NREL 2015). Socioeconomic impacts from wind energy development are typically positive impacts related to additional employment.

Cumulative impacts to property values can result from the presence of structures and changes to the viewshed. Cumulative impacts depend on the density of visible offshore development and its distance from shore.

Environmental justice impacts are environmental or economic impacts to minority or low-income populations. IPFs from a variety of activities that affect demographics and employment have the potential to disproportionately affect certain populations. These impacts are likely to be highly site-specific and require review for every specific project (NREL 2015). Considering that major activities for offshore development would occur at a distance away from populations, the temporary onshore construction would likely have the largest potential environmental justice implications (BOEM 2012d; 2018a). These impacts could include adverse health impacts from air emissions and noise, which could negatively affect local populations, as well as potential adverse impact on environmental justice communities, such as low-income residents involved in the commercial fishing industry or tourism industry. Construction, operation and decommissioning of facilities have a variety of impacts ranging from air, water and noise pollution as well as potentially affecting land use and property values disproportionately (MMS 2007, Heintzelman & Tuttle 2012). The potential for cumulative environmental justice impacts depends on the regional distribution of minority and low-income population groups (BOEM 2012d).

### *Dredged material ocean disposal*

There are 8 active projects and 8 inactive/closed projects identified in the South Atlantic AOI (Table 3-10). Ocean disposal of dredge material has decreased as beneficial reuse has increased. USACE reported that about 20% to 30% of port and waterway dredged material is used for habitat creation and other beneficial uses (USACE 2012). With increased port expansion/dredging projects to handle post-Panamax vessels, BOEM expects ocean disposal activity to remain stable or increase.

Vessels required for dredging and disposal activities create oceangoing traffic as well as air emissions and noise associated with those vessels. Additional dredging and disposal activities could increase traffic and potentially create environmental justice issues. There are 11 dredged material disposal sites designated in the South Atlantic with four on the South Carolina coast, three along the North Carolina coast and four along the Florida coast (not including the Straits of Florida planning area) (USACE 2019). The majority of dumping activity occurs at these designated sites (MMS 2007). Potential environmental justice issues from dredging and disposal activities would be localized and concentrated around these areas.

### *Commercial and recreational fishing*

Commercial and recreational fishing can affect demographics, employment and environmental justice populations through several IPFs. In 2017, seven of the top 100 commercial fishing ports (by value) in the country are in the South Atlantic from North Carolina to Florida, which provide over $100 million to local economies (NOAA 2019d). Vessels conducting fishing activity (both commercial and recreational) can create air emissions, noise and traffic. Increases in fishing activity would create new employment opportunities; however, resource exploitation (e.g., overfishing) or regulations restricting fishing during certain periods of the year could result in constrained fishing effort, and lower employment levels (BOEM 2016c). Fishing communities are often of particular concern with regard to environmental justice issues as they are often low-income or minority communities (BOEM 2014a). Thus, changes in fishing activity in the region may be an important factor to consider when evaluating cumulative environmental justice impacts.

### *Land use and coastal infrastructure*

Impacts to demographics, employment and environmental justice from onshore infrastructure would be related to onshore construction, port utilization and vessel traffic transiting to and from ports. Additional vessel traffic associated with ports could impact demographics, employment and environmental justice both positively and negatively. Some growth in employment and associated economic activity would be expected in areas where port expansion is occurring; these areas include many ports along the Atlantic coast offshore of North Carolina to Florida (see Chapter 3 for a table illustrating expected port developments). As of 2019, all principal ports in the region have planned or ongoing development activities, which may also lead to an increased need for support services onshore which could affect employment and demographics in the surrounding region. Baseline levels of port utilization and vessel traffic need to be considered when determining the significance of potential cumulative impacts. Data sources described in Section 3.6 and 3.11 can help determine baseline activity levels.

Vessel traffic to and from ports can create oceangoing traffic as well as air emissions and noise, which can potentially add to cumulative negative impacts on environmental justice populations. In addition, light associated with industrial facilities in coastal areas may affect local communities. Construction activities associated with port development and other coastal infrastructure could also create air emissions, noise and light. These IPFs should be considered to assess environmental justice issues.

### *Marine minerals extraction*

Marine minerals extraction occurs in the study area in particular locations. Sand and gravel mining along the Atlantic coast offshore of North Carolina to Florida includes use of existing and potential borrow sites where sand mining will occur. In total, there are three active sites in the South Atlantic, while many others have now closed or expired as of 2019 (see Section 3.3). Beach restoration associated with marine minerals mining has the potential to impact demographics and employment positively as well. During the restoration activity, employment may be positively affected if the restoration activity creates jobs. Once the restoration is complete, this could positively affect the local environment.

States also have active minerals mining and channel dredging activities that support numerous local beach renourishment projects. However, the type and availability of data on these projects vary widely at the state and county level. Evaluating the potential interactions with offshore wind energy development and such local projects appears to require real-time effort at state- and county-level offices. The Army Corps of Engineers (USACE 2020).may have the most comprehensive source of information on these local projects at its USACE Jurisdictional Determinations and Permit Decisions website: https://permits.ops.usace.army.mil/orm-public.

Vessels utilized for marine minerals surveys are typically smaller vessels that employ fewer people than larger seismic survey vessels (BOEM 2014a). Survey vessels create light, noise and air emissions that could potentially impact onshore communities adversely through cumulative pollution of the local environment. Light, noise and air emissions resulting from vessels use in marine minerals extraction activities should be considered to assess cumulative environmental justice impacts.

### *Marine transportation*

Marine transportation is an ongoing, regular activity that generates substantial vessel traffic in locations along the Atlantic coast offshore of North Carolina to Florida. Changes in port utilization for marine transportation purposes could have impacts on local economies, in terms of increased employment and economic activity. Vessel traffic associated with marine transportation would create air emissions and noise that may adversely impact coastal communities. Close to shore, traffic is concentrated in key shipping channels and port areas (BOEM 2014a). In particular, key shipping channels, where larger vessel traffic such as tanker and cargo vessels is more concentrated, are located near the coast. These areas are typically lanes leading out from the principal ports along the coast and can be seen in Figure 3.8 in Chapter 3.6. Environmental justice issues should be considered where cumulative impacts from marine transportation and other activities may occur.

### Military use, military range complexes, civilian space programs

Activities might be restricted in military range complexes and civilian space program use areas causing disruptions to economic activity. The Navy's standard operating procedures require that an area is clear of non-participating vessels and aircraft before an activity using ordnance or expended materials occurs (Navy 2018). Temporary and short duration (hours) impacts may occur from limits on accessibility to marine areas used for fishing or tourism and hence result in a loss of income; however, most limitations on accessibility are temporary and would be lifted upon completion of training and testing activities (Navy 2018). Similarly, people may experience noise from vessels or aircraft involved in training or testing activity. These occurrences would likely be of short duration and infrequent, and other than transiting vessels and aircraft, noise from military activities is often further from shore than fishing or recreational activities. Impacts on socioeconomic resources from military activities would be unlikely contribute to cumulative impacts due to their short-term and limited nature.

There is the potential for increases in civilian space program activity, specifically at the Kennedy Space Center, which would likely be longer in duration than the military effects on socioeconomics described above. Increased civilian space program activity could increase employment opportunities both directly with civilian space activity at sites as well as indirectly with local support activities resulting in positive effects. At least one previous analysis found that positive effects from space program development would positive socioeconomic effects that would last up to two decades. The magnitude of long-term effects would be dependent on NASA, DOD and commercial investment (NASA 2019). Short term positive effects would likely also occur for any increased construction activities associated with civilian space programs (NASA 2019).

Similar to other activities involving vessel traffic, vessels associated with military use and programs have the potential to create noise, air emissions and light offshore, which have the potential to affect onshore communities and should be considered to assess cumulative environmental justice impacts.

### Oil and gas surveys and extraction

The Atlantic has seen minimal oil and gas development interest and activity from the 1970s through the present: between 1979 and 1984 eight exploratory wells were drilled with no economically viable discoveries. The current five-year OCS oil and gas lease sale plan has no lease sales scheduled through 2022. Any projections for future leasing in the Atlantic would be speculative. Therefore, the cumulative impact scenario considers only the impacts of G&G activities. When leases sales are conducted, the full list of oil and gas development- related IPFs will need to be assessed.

BOEM has received several permit requests for G&G surveys in support of oil and gas exploration, and industry has expressed interest in expanding activities into Atlantic offshore waters (BOEM 2019e). G&G surveying activities have the potential to impact demographics, employment and environmental justice through creation of additional traffic and changes to port utilization. These vessel trips could create additional employment opportunities and generate income for local communities. The type of surveys being conducted for oil and gas development would determine the number of potential jobs created; however, in 2014 BOEM did not find that these activities create new jobs as they often require specialized expertise (BOEM 2014a).

Indirect economic impacts from these activities nevertheless generate economic benefits to the port sites and surrounding areas where the survey crews are based. These are positive, temporary impacts, which should be considered in comparison to baseline levels of economic activity. Survey vessels also create light, noise and air emissions that could potentially impact onshore communities and should be considered to assess cumulative property value and environmental justice impacts.

If oil and gas development occurs in the future, onshore support activities that could affect and economic development include installation of onshore pipeline infrastructure and support facilities, changes to existing zoning, and construction of roads (BOEM 2016a).

### *Renewable energy development, wind*

Construction and development of wind energy may result in short-term impacts to demographics and employment in localized areas. Impacts of construction, operation and decommissioning would likely be small as diverse local economic infrastructure and labor markets would be able to meet demand (MMS 2007). BOEM estimates that three direct jobs are created per wind turbine during construction and one during operation/decommissioning (MMS 2007). Cumulatively these impacts would depend on the number facilities in a single region; however, the cumulative impact is still likely to be small (MMS 2007).

Construction/installation of wind energy has the potential to impact onshore populations by creating noise and vessel activity; however, permitting processes would likely ensure that these impacts are limited. The presence of wind turbines as well as light from these facilities along the coastline could result in visual impacts. Air emissions, noise and light as well as vessel traffic impacts from the construction, installation, operation and decommissioning of wind energy projects would be localized and should be considered to assess cumulative environmental justice impacts.

Offshore wind energy development has the potential to impact demographic, employment and environmental justice activity in a variety of ways.

- *Site characterization surveys*. Surveys have the potential to add vessel traffic and create direct employment for a coastal port community (BOEM 2014a).
- *Installation of meteorological towers and/or meteorological buoys*. Depending on the location of towers/buoys, this may result in viewshed or light impacts on environmental justice communities and also could impact property values.
- *Installation/Decommissioning of turbine structures.* This can result in positive effects on employment activity during construction, installation, and decommissioning. However, this would be temporary and there would be smaller employment impacts during the operation of a turbine.
- *Presence of turbine structures*. Depending on the location of turbines, this may result in viewshed or light impacts on environmental justice communities and could also impact property values.

Whether the presence of structures related to wind energy activities will contribute to cumulative impacts on environmental justice or property values depends on the siting of the project and the staging point. Cumulative impacts could occur if multiple offshore wind energy facilities were sited in close proximity to one another with socioeconomic impacts focused in certain coastal communities (MMS 2007).

### *Submarine cables, transmission/telecommunication lines, pipelines*

The Atlantic coast offshore of North Carolina to Florida contains minimal existing undersea cable infrastructure. The impacts to demographics, employment and environmental justice from existing and new submarine cables, transmission/ telecommunication lines, pipelines are related to the vessel traffic associated with installation and O&M. The size of a survey vessel and the installation vessel determine the number of potential jobs created. Onshore construction of a landing station for the cable could also create temporary local jobs. Vessels involved in installation and O&M for submarine cables, transmission/ telecommunication lines, and pipelines also create light, noise and air emissions that could potentially impact onshore communities adversely through cumulative pollution of the local environment and should be considered to assess cumulative environmental justice impacts.

### *Climate change*

Climate change disrupts geophysical and biological resources globally (see Section 3.8). Climate change will directly or indirectly alter the impacts of IPFs that affect socioeconomics by impacting coastal communities through property loss, property value changes, and higher costs of maintenance or insurance due to more frequent storms. To the degree wind energy development offsets the use of fossil fuel used to generate power, it will reduce carbon emissions and further efforts to reduce global warming.

#### *4.3.3.2 Cultural and Historic Resources*

**Table 4-18. Cumulative Impacts Scenario IPFs – Cultural and Historic Resources**

| | Dredge Material Ocean Disposal | Commercial and Recreational Fishing | Land Use /Coastal Infrastructure | Marine Minerals Extraction | Marine Transportation, Navigation, and Traffic | Military Ranges & Civilian Space Program Uses | Oil and Gas Surveys and Extraction | Renewable Energy-Wind | Submarine Cables, Lines, & Pipelines | Climate Change |
|---|---|---|---|---|---|---|---|---|---|---|
| **Offshore Wind Energy Development IPFs** | | | | | | | | | | |
| Accidental releases | ● | ● | ● | ● | ● | ● | ● | ● | ● | |
| Anchoring | | | | | | ● | ● | ● | | |
| Discharges | ● | ● | ● | ● | ● | ● | ● | ● | ● | |
| Energy generation, energy security | | | | | | | | ● | | ● |
| Light | | ● | ● | | ● | ● | ● | ● | | |
| New cable emplacement/maintenance | | | | | | | | ● | ● | ● |
| Port utilization | ● | | | | ● | | ● | ● | | ● |
| Presence of structures | | | ● | | | ● | ● | ● | ● | ● |
| **Cumulative Impact Scenario, Other IPFs** | | | | | | | | | | |
| Beach restoration | ● | | | ● | | | | | | ● |
| Demolition/structure removal | | | | | | ● | ● | | | |
| Gear utilization | | ● | | ● | | ● | | | | ● |
| Land disturbance | | | ● | | | | ● | | | ● |
| Ocean acidification | | | | | | | | | | ● |
| Port utilization, maintenance, dredging | ● | | | | | | | | | ● |
| Pipeline trenching | | | | | | | ● | | | |
| Sediment deposition and burial | ● | | | | | | | | | ● |
| Warming and sea-level rise | | | | | | | | | | ● |

Cultural resources are the “broad array of stories, knowledge, people, places, structures, and objects, together with their associated environment, that contribute to the maintenance of cultural identity and/or reveal the historic and contemporary human interactions with an ecosystem. This can include both tangible and intangible cultural heritage (BOEM 2015c). Tangible heritage includes buildings and historic places, monuments and artifacts that are considered worthy of preservation for the future. Tangible heritage also includes, but is not limited to, historic properties such as buildings, districts, sites, structures and objects that have been recognized by federal or state government, as well as Traditional Cultural Properties (TCPs).

TCPs may be eligible for inclusion in the National Register of Historic Places (NRHP) based on associations with the cultural practices, traditions, beliefs, lifeways, arts, crafts, or social institutions of a living community. Intangible heritage includes the practices, representations, expressions, knowledge, and skills that communities, groups, and in some cases, individuals recognize as their cultural heritage. Although many have been discovered and protected, numerous forgotten, undiscovered, or unprotected cultural resources exist in the marine, onshore, and nearshore environments. Although neither NEPA nor any other federal law defines “cultural resource,” several laws and executive orders deal with resources that are cultural in character.

Activities and associated IPFs occurring along the Atlantic coast offshore of North Carolina to Florida have the potential to impact cultural resources if they result in seabed or land disturbance or affect culturally important viewsheds or visually sensitive resources. Similarly, proposed wind energy projects have the potential to affect cultural resources if they disturb the seabed or land areas, or affect culturally important viewsheds or visually sensitive resources. In areas where seabed cables are common, cumulative impacts to cultural resources may be important to consider, although siting multiple seabed cables in the same corridor may reduce cumulative impacts.

Historic and cultural resources are found along much of the Atlantic coast from North Carolina to Florida. Identified shipwrecks, which constitute some of the many offshore cultural resources, are largely concentrated around existing ports and shipping channels along the South Atlantic coast from North Carolina to Florida (NOAA 2018h). An existing BOEM database of reported shipwreck locations off the Atlantic coast that includes information on historic shipping and shipwreck information with vessel and period type (BOEM 2012c, BOEM 2015c).

Also possible offshore are pre-contact period archaeological sites within a paleolandscape dating from around the time of the last Ice Age, when sea levels were about 200 feet lower than today (BOEM 2012c, Anderson & Gilliam 2000, Gornitz 2009). Analysts should consider that any listings of identified cultural resources likely do not fully represent the extent of cultural resources offshore, which include submerged pre-contact period archaeological sites, sunken ships and downed aircrafts, as well as other sites deemed to possess historical value in the state or federal jurisdictions in whose waters they are located.

For activities that could affect culturally important viewsheds, there is an additional BOEM evaluation of visual impacts on cultural and historic properties on the Atlantic coast that contains an inventory of onshore historic properties for analysts to consult (BOEM 2012d). This study was conducted in collaboration with state and local preservation offices and identified 9,600 cultural resources and historic properties. Of these properties, 1,085 were identified as having a significant maritime setting and significant view to the sea and 7,932 had a significant maritime setting but not a significant view to the sea (BOEM 2012d). Analysts should consider that the listings of identified cultural resources likely do not fully represent the extent of cultural resources offshore, which include submerged prehistoric cultural sites, abandoned properties, sunken ships, as well as other sites deemed to possess historical value in the state or federal jurisdictions in whose waters they are located.

To the extent that onshore facilities will be developed in recently undisturbed areas, potential cumulative impacts to cultural resources are important to consider. In addition, oil spills or other accidental releases have the potential to damage onshore and offshore cultural resources. The likelihood of accidental releases is higher in areas with larger ports and vessel activities (BOEM 2015). Offshore cultural resources are generally unlikely to be affected by offshore wind development activities, as BOEM's mitigation strategy is, to first require survey to identify potential offshore cultural resources, and, if feasible, avoidance (BOEM 2012a). For example, siting of meteorological towers and buoys would be adjusted to avoid adverse effects to offshore cultural resources. Avoidance may not always be possible for full commercial construction activities.

The following subsections discuss the potential IPFs and impacts of each activity on cultural resources.

### *Dredged material ocean disposal*

There are 8 active projects and 8 inactive/closed projects identified in the South Atlantic AOI (Table 3-10). Ocean disposal of dredge material has decreased as beneficial reuse has increased. USACE reported that about 20% to 30% of port and waterway dredged material is used for habitat creation and other beneficial uses (USACE 2012). With increased port expansion/dredging projects to handle post-Panamax vessels, BOEM expects ocean disposal activity to remain stable or increase.

Dredged materials disposal occurs in designated areas offshore in the marine environment. Fill in these areas has likely resulted in impacts to submerged cultural resources if they are present within the designated disposal area. EPA has site designation criteria that include consideration of proximity to historical/cultural sites and prepares EAs or EISs when designating sites. Thus, the likelihood of impacts on cultural resources from authorized ocean disposal is low. However, vessels used in dredged materials disposal have the potential for discharges, spills of fuel or fluids or dredge material that could cause damage to cultural resources outside of the disposal site. New wind energy development is unlikely to directly interact with these impacts, but to the extent that an offshore wind project is planned near an existing disposal site, potential cumulative impacts to cultural resources should be considered.

#### *Commercial and recreational fishing*

Fisheries that utilize bottom gear (e.g. traps, pots, or dredges) may affect cultural resources by moving, breaking, or destroying resources (gear utilization IPF). While these actions are very localized, they also occur frequently in many areas along the Atlantic coast offshore from North Carolina to Florida. Impacts of future wind energy projects would be additive to other impacts that have occurred related to bottom gear use by commercial as well as recreational fisheries. In addition, vessels used in commercial and recreational fisheries have the potential for spills of fuel or fluids as well as discharges, which could cause damage to cultural resources.

#### *Land use and coastal infrastructure*

Many coastal shore land areas along the Atlantic coast from North Carolina to Florida have been disturbed by human development over time. To the extent that onshore facilities will be developed in previously undisturbed areas, and particularly undisturbed areas nearby disturbed areas, cumulative impacts to cultural resources may be important. The expansion and development of existing port infrastructure also has the potential to affect cultural resources on coastal land areas. There also is the potential for light from onshore development to affect culturally important viewsheds.

#### *Marine minerals extraction*

Marine minerals extraction occurs in the study area in specified, designated locations. Sand and gravel mining along the Atlantic coast offshore of North Carolina to Florida includes use of existing and potential borrow sites where sand mining will occur and may have affected cultural resources. Based on technology and cost factors, sand mining activity appears limited to depths less than 30 m (98 ft) (BOEM 2014c). New wind energy development is possible but unlikely to interact directly with impacts of marine mineral extraction activities. OCS wind developers are likely to avoid laying cables through borrow areas to avoid the potential damage that dredging activities could inflict.

States also have active minerals mining and channel dredging activities that support numerous local beach renourishment projects. However, the type and availability of data on these projects vary widely at the state and county level. Evaluating the potential interactions with offshore wind energy development and such local projects appears to require real-time effort at state- and county-level offices. The Army Corps of Engineers (USACE 2020).may have the most comprehensive source of information on these local projects at its USACE Jurisdictional Determinations and Permit Decisions website: https://permits.ops.usace.army.mil/orm-public.

To the extent that a wind energy project is planned near sand mining activities, the potential interaction and combined cumulative impacts to cultural resources should be considered. In total, there are three active sites in the South Atlantic, while many others have now closed or expired as of 2019 (see Section 3.3). In addition, vessels used in marine minerals extraction have the potential for discharges and spills of fuel or fluids which could cause damage to cultural resources. It is also possible the export cables could occur within or close to a borrow area and be damaged from dredging operations (gear utilization IPF). Thus, coordination with BOEM Marine Minerals Program (MMP) is called for to avoid potential conflicts.

#### *Marine transportation*

Marine transportation is an ongoing, regular activity that generates substantial vessel traffic in locations along the Atlantic coast offshore of North Carolina to Florida. While generally speaking, vessel traffic is not anticipated to substantially affect cultural resources, accidental releases as well as discharges from vessels, as well as changes to port utilization associated with vessel traffic could have effects on cultural resources.

#### *Military use, military range complexes, civilian space programs*

Repetitive and routine military training activities could result in impacts to cultural resources if they affect the seabed or otherwise undisturbed land areas. To the extent that future wind energy projects are planned near ongoing military activities, cumulative impacts to cultural resources should be considered. In addition, vessels used in military or civilian space programs have the potential for discharges and spills of fuel or fluids which could cause damage to cultural resources.

#### *Oil and gas surveys and extraction*

The Atlantic has seen minimal oil and gas development interest and activity from the 1970s through the present. The current five-year OCS oil and gas lease sale plan has no lease sales scheduled through 2022. Any projections for future leasing in the Atlantic would be speculative. Therefore, the cumulative impact scenario considers only the impacts of G&G activities. When leases sales are conducted, the full list of oil and gas development- related IPFs will need to be assessed.

BOEM has received several permit requests for G&G surveys in support of oil and gas exploration, and industry has expressed interest in expanding activities into Atlantic offshore waters (BOEM 2019e). G&G surveying activities have the potential to affect cultural resources if they affect the seafloor as well as through use of temporary or permanent lighting both onshore and offshore. New wind energy development is unlikely to directly interact with impacts of G&G surveys.

However, to the extent that a new wind energy project is planned near an area being surveyed, cumulative impacts to cultural resources should be considered. In addition, vessels used in G&G surveying activities have the potential for discharges and spills of fuel or fluids which could cause damage to cultural resources. If oil and gas development occurs in the future, support activities that could affect cultural and historic resources include installation of onshore pipeline infrastructure and support facilities (BOEM 2016a).

#### *Renewable energy development, wind*

Wind energy development has the potential to impact cultural resources in a variety of ways. Seafloor disturbance can result from construction activities, such as excavations for offshore turbine installation, offshore drilling, or offshore cable placement; this in turn can result in destruction or removal of cultural resources from their primary context. There is also the potential that the presence of wind turbines can affect cultural resources on the coast if visual factors are important for maintaining the integrity of the resource (MMS 2007).

In addition, and similar to other activities involving vessel traffic, vessels associated with construction, decommissioning, and O&M for wind energy have the potential to impact cultural resources through accidental releases. Accidental releases or discharges of fuel/fluids from service vessels, or spills of other fluids (e.g., dielectric fluids from alternative energy facility electric support platforms), could harm cultural resources. The expansion and development of existing port infrastructure to accommodate renewable energy development also has the potential to affect cultural resources on coastal shore land areas.

#### *Submarine cables, transmission/ telecommunication lines, pipelines*

The Atlantic coast offshore of North Carolina to Florida contains minimal existing undersea cable infrastructure. Installation submarine cables, transmission/ telecommunication lines, pipelines may create seafloor disturbances, which may impact affect cultural resources. In addition, discharges and accidental releases of fuel or fluids from operation of pipelines, or from vessels used in installation or O&M could cause damage to cultural resources.

### *Climate change*

As described in Section 3.8, climate change disrupts geophysical and biological resources around the world. Climate change will directly or indirectly alter the impacts of IPFs that affect cultural/historic resources by loss (submerging) of coastal resources/lands and destruction of properties due to flooding/storms. To the degree wind energy development offsets the use of fossil fuel used to generate power, it will reduce carbon emissions and further efforts to reduce global warming.

#### *4.3.3.3 Visual Resources*

**Table 4-19. Cumulative Impacts Scenario IPFs – Visual Resources**

| | Dredge Material Ocean Disposal | Commercial and Recreational Fishing | Land Use /Coastal Infrastructure | Marine Minerals Extraction | Marine Transportation, Navigation, and Traffic | Military Ranges & Civilian Space Program Uses | Oil and Gas Surveys and Extraction | Renewable Energy-Wind | Submarine Cables, Lines, & Pipelines | Climate Change |
|---|---|---|---|---|---|---|---|---|---|---|
| **Offshore Wind Energy Development IPFs** | | | | | | | | | | |
| Light | | ● | ● | | ● | ● | ● | ● | | |
| Port utilization | ● | | | | ● | | ● | ● | | ● |
| Presence of structures | | | ● | | | ● | ● | ● | ● | ● |
| Traffic | ● | ● | ● | ● | ● | ● | ● | ● | ● | |
| **Cumulative Impact Scenario, Other IPFs** | | | | | | | | | | |
| Beach restoration | ● | | | ● | | | | | | ● |
| Demolition/structure removal | | | | | | ● | ● | | | |
| Land disturbance | | | ● | | | | ● | | | ● |
| Port utilization, maintenance, dredging | ● | | | | | | | | | ● |
| Warming and sea-level rise | | | | | | | | | | ● |

Visual resources include the aesthetic, perceptual, and experiential aspects of any objects and features that make landscapes and seascapes distinctive as well as key observation points (also known as KOPs, considered representative of the varied character of the landscape or seascape and typical observer experience). Impacts to visual resources may negatively or positively affect the perceived quality of a landscape or seascape and may affect the “feel,” “character” or “sense of place” of an area. Visual impacts tend to come from three sources: the addition of an element or features, change or loss of existing visual elements or features and the combined effects on views or visual amenity. Whether impacts are perceived positively or negatively depends on the visual impact receivers (i.e. viewers), how much they value the visual resources as well as how many viewers there are and how familiar viewers are with the land or seascape or other site-specific factors (BOEM 2018c).

Activities and associated IPFs occurring off the Atlantic coast offshore of North Carolina to Florida could result in potential short-term impacts to visual resources if they result in onshore or coastal construction activities. Offshore construction activities may affect visual resources depending on the distance of those activities to shore as well as seasonal weather and lighting conditions. Long-term impacts on visual resources could result from development of permanent structures onshore or offshore, as well as continuing increases in vessel traffic. While many activities result in vessel traffic that transit seascapes, it should be noted that onlookers are unlikely to be able to distinguish the specific activities resulting in vessel traffic offshore. Baseline levels of vessel traffic need to be considered when determining the significance of potential cumulative impacts.

Wind energy development projects may add to both short-term and long-term impacts to visual resources through construction activities as well as longer-term operations. Similarly, impacts would be larger in undeveloped areas where new infrastructure could permanently affect viewsheds (BOEM 2016a). Impacts to visual resources are highly site-specific and can depend on the number of viewers as well as the perception of impacts by different viewers (e.g., some viewers might find the appearance of wind turbines to be a positive addition to the viewshed) (MMS 2007). The distance from shore and the height of offshore structures or vessels would also determine the level of visual impacts (BOEM 2016c). Field observations of offshore wind facilities in the United Kingdom revealed that the facilities may be visible at distances of 26 mi (42 km) in daytime and 24 mi (39 km) in nighttime views and may be a major focus of visual attention at distances of up to 10 mi (16 km) (Argonne 2018).

Cumulative impacts to visual resources can occur when the presence of multiple projects considered together change the essential character of the seascape or landscape, for example (BOEM 2018c):

- Where multiple offshore facilities or structures are within the same view without a viewer turning their head;
- Where multiple facilities or structures can be seen successively if the viewer turns their head; or
- Where multiple facilities are viewed in succession as the viewer moves through the landscape. In this case, multiple facilities can affect the viewing experience for moving viewers even if the facilities are not visible from a single viewpoint.

During the North Carolina offshore wind planning process, BOEM commissioned a report on visual effects of wind turbines offshore North Carolina. The analysis found that visibility was lowest in the summer and highest in the winter and fall and that there was little variability in visibility along the North Carolina coast due to the consistent nature of meteorological conditions along the North Carolina coast (BOEM 2012). Further, the analysis found that that visibility (when measured as the percent of days that the site is visible for at least half of the day) fell from 35% to 18% when distances from shore were increased from 10 nm to 20 nm (BOEM 2012). For reference, the Kitty Hawk lease area is roughly 24 nm offshore North Carolina.

Cumulative impacts to visual resources that are most likely to be significant are those that change the seascape/landscape character through major effects on its key characteristics, or that transform it into a different seascape/landscape type entirely. This may happen if the proposed project “tips the scale” by adding its effects to the combined impacts of existing or planned projects/activities (BOEM 2018c). BOEM is developing additional, specific guidance on evaluating cumulative visual impacts, with a release date that is to be determined. It is likely that this guidance will be refined over time as experience, changes in technology, and public input shape the approach for evaluating visual impacts for offshore wind projects in the United States.

#### *Dredged material ocean disposal*

There are 8 active projects and 8 inactive/closed projects identified in the South Atlantic AOI (Table 3-10). Ocean disposal of dredge material has decreased as beneficial reuse has increased. USACE reported that about 20% to 30% of port and waterway dredged material is used for habitat creation and other beneficial uses (USACE 2012). With increased port expansion/dredging projects to handle post-Panamax vessels, BOEM expects ocean disposal activity to remain stable or increase.

Vessels required for dredging and disposal activities create oceangoing traffic, which can interfere with visual resources. The majority of dumping activity occurs at these designated sites (MMS 2007). Vessel traffic impacts to visual resources from dredging and disposal activities would be concentrated around these areas.

#### *Commercial and recreational fishing*

Fisheries management activities limit fisheries through a variety of closures, which remove vessels from certain areas. These closures could limit the number of vessel transits through a specific viewshed. Closures and restrictions depend on species, season and location. For example, certain areas are closed to trap/pot fishing at certain times to protect the right whale (83 FR 49046). Ongoing trends in fisheries are important for analysts to consider in cumulative impacts analyses for wind projects.

#### *Land use and coastal infrastructure*

Impacts to visual resources from onshore infrastructure would be related to coastal infrastructure and vessel traffic transiting to and from ports. Additional vessel traffic associated with ports could impact visual resources negatively. Some growth in vessel traffic to and from ports would be expected in areas where port expansion is occurring; these areas include many ports along the Atlantic coast offshore of North Carolina to Florida (see Chapter 3 for a table illustrating expected port developments). In addition, analysts should consider specific local land use areas where coastal development and onshore activity is concentrated as these visual impacts will be site-specific and dependent on siting (MMS 2007). In some cases, construction or land disturbance onshore can also create visual impacts that should be considered in the cumulative impacts analysis. Larger onshore facilities are more likely to have impacts on coastal visual resources as both the facility structures and the light they generate are visible at greater distances (BOEM 2016a). Nighttime visual impacts from direct glare and sky glow can occur at larger facilities (BOEM 2016a).

### *Marine minerals extraction*

Marine minerals extraction occurs in the study area in particular locations. Sand and gravel mining along the Atlantic coast offshore of North Carolina to Florida includes use of existing and potential borrow sites where sand mining will occur. Additional vessel traffic associated with these activities may affect visual resources. Based on technology and cost factors, sand mining activity appears limited to depths less than 30 m (98 ft) (BOEM 2014a), which would likely be nearshore and contribute to impacts on visual resources.

States also have active minerals mining and channel dredging activities that support numerous local beach renourishment projects. However, the type and availability of data on these projects vary widely at the state and county level. Evaluating the potential interactions with offshore wind energy development and such local projects appears to require real-time effort at state- and county-level offices. The Army Corps of Engineers (USACE 2020).may have the most comprehensive source of information on these local projects at its USACE Jurisdictional Determinations and Permit Decisions website: https://permits.ops.usace.army.mil/orm-public.

### *Marine transportation*

Marine transportation is an ongoing, regular activity that generates substantial vessel traffic in locations along the Atlantic coast offshore of North Carolina to Florida. Close to shore, traffic is concentrated in key shipping channels and port areas. Vessel traffic associated with marine transportation may interfere with visual resources in the same locale. Shipping fairways, traffic lanes, anchorage areas, separation, danger, and safety/security zones, and other navigational areas designated to provide safe access routes to and from ports also have an impact in terms of concentrating vessel traffic. In addition, there are seasonal vessel speed restrictions in place along much of the South Atlantic coast from North Carolina to Florida to protect the North Atlantic right whale. Fishing, dredging, and military vessels are typically exempted from these rules. These closures could result in negative effects related to commercial vessel traffic in the viewshed when they comply with the speed restrictions, hence remaining in the viewshed longer than under normal speed. However, analysts should also note that larger vessels typically transit farther from shore (i.e., outside the speed restrictions and further from the shoreline view) than smaller vessels. As such, the effects of these speed restrictions on viewsheds may be small (see Figure 3-7 in Section 3-6).

### *Military use, military range complexes, civilian space programs*

Construction of facilities offshore as well as the presence of military operations onshore can affect visual resources. The Navy's standard operating procedures require that an area is clear of non-participating vessels and aircraft before an activity using ordnance or expended materials occurs (Navy 2018). Some military activity may limit accessibility to marine areas (Navy 2018); this could result in positive impacts as areas have reduced non-military vessels in the seascape. Repetitive and routine training could result in additional impacts. Increases in civilian space programs at the Kennedy Space Center could also result in new structures and light sources that could result in negative impacts to visual resources (NASA 2019). All new sources of light at Kennedy Space Center must comply with guidelines from the Kennedy NASA Procedural Requirements that could mitigate the potential for negative effects of new light sources on visual resources (NASA 2018).

Similar to other activities involving vessel traffic, vessels associated with military use and programs have the potential to affect visual resources as they pass through seascapes. Cumulative impacts would be expected in and adjacent to areas where military training or testing activity occurs (Navy 2018).

### *Oil and gas surveys and extraction*

The Atlantic has seen minimal oil and gas development interest and activity from the 1970s through the present: between 1979 and 1984 eight exploratory wells were drilled with no economically viable discoveries. The current five-year OCS oil and gas lease sale plan has no lease sales scheduled through 2022. Any projections for future leasing in the Atlantic would be speculative. Therefore, the cumulative impact scenario considers only the impacts of G&G activities. When leases sales are conducted, the full list of oil and gas development- related IPFs will need to be assessed.

BOEM has received several permit requests for G&G surveys in support of oil and gas exploration, and industry has expressed interest in expanding activities into Atlantic offshore waters (BOEM 2019e). G&G surveying activities have the potential to impact visual resources through creation of additional traffic. Transportation of oil and gas including tankers and other vessels can result in visual impacts (BOEM 2016a). If installed, oil and gas infrastructure offshore would have visual impacts related to the offshore construction and structures as well as lighting, but currently none exist in the North Atlantic OCS.

### *Renewable energy development, wind*

Wind energy development has the potential to impact visual resources in a variety of ways.

- *Meteorological towers and/or meteorological buoys.* Depending on the location of towers/buoys, this may affect visual resources. Due to their lower height than wind energy turbines, impacts would be expected to be negligible to minor with towers likely be out of the view of onshore viewers. Due to curvature of the earth, towers would likely fall below the horizon for onshore viewers depending on the height and distance with shorter towers falling below the horizon at a closer distance (e.g., BOEM determined that a tower with an assumed height of 394 ft would fall below the horizon at a distance of 23.5nm, any lower towers would fall below the horizon at a closer distance) (BOEM 2016c). Offshore light from meteorological towers, if visible, would likely be indistinguishable from ongoing vessel traffic and other offshore light with negligible or minor impacts depending on the type of lighting (BOEM 2016c).
- *Turbine structures.* Multiple wind energy projects could have aggregation effects on visual resources. Turbines can result in positive or negative effects on visual resources depending on perceptions of wind turbines in the region and would be likely to be long term based on project lifetimes. The further from shore turbines are sited the lower the impact to visual resources with the potential for minor impacts to visual resources. For Vineyard Wind, turbines would be visible at distances less than 27.4 miles from shore and between this distance and 35.3 miles the top of rotors could be visible from shore (BOEM 2018a). Decommissioning of facilities could also affect positively or negatively visual resources, but impacts would be brief. Towers would have very brief but major visual impacts to vessels close by. Light impacts would be limited by the distance to shore (BOEM 2018a).
    - Atmospheric conditions could limit the amount of time turbines are visible from shore reducing any impacts to visual resources (BOEM 2018a).
    - Inshore views can be obstructed by onshore structures and landscape features making visual impacts concentrated at coastal areas and beach front that has unobstructed views (Epsilon Associates 2018).

Cumulative impacts to visual resources from wind energy development could be larger if projects are sited in close proximity to each other and clearly visible from one viewpoint. This is particularly true if the facilities create a visual “wall” across the view. In addition, similar to other activities involving vessel traffic, vessels associated with construction and O&M for wind energy have the potential to affect visual resources though this is likely to be difficult to distinguish from regular vessel traffic.

### *Submarine cables, transmission/telecommunication lines, pipelines*

The Atlantic coast offshore of North Carolina to Florida contains minimal existing undersea cable infrastructure. The impacts to visual resources from existing and new submarine cables, are related to the vessel traffic associated with installation and O&M. Onshore facilities for connection of undersea cables could impact visual resources permanently but the size and nature of onshore substations and other equipment as well as proximity to viewers would determine the level of impact. Visual impacts from associated construction would be temporary but the facilities would be permanent (MMS 2007).

### *Climate change*

Climate change disrupts geophysical and biological resources around the world (see Section 3.8). Climate change will directly or indirectly alter the impacts of IPFs. To the degree wind energy development offsets the use of fossil fuel used to generate power, it will reduce carbon emissions and further efforts to reduce global warming.

#### *4.3.3.4 Tourism and Recreation*

**Table 4-20. Cumulative Impacts Scenario IPFs – Tourism & Recreation**

| | Dredge Material Ocean Disposal | Commercial and Recreational Fishing | Land Use /Coastal Infrastructure | Marine Minerals Extraction | Marine Transportation, Navigation, and Traffic | Military Ranges & Civilian Space Program Uses | Oil and Gas Surveys and Extraction | Renewable Energy-Wind | Submarine Cables, Lines, & Pipelines | Climate Change |
|---|---|---|---|---|---|---|---|---|---|---|
| **Offshore Wind Energy Development IPFs** | | | | | | | | | | |
| Accidental releases | ● | ● | ● | ● | ● | ● | ● | ● | ● | |
| Light | | ● | ● | | ● | ● | ● | ● | | |
| Noise | ● | ● | ● | ● | ● | ● | ● | ● | ● | |
| Presence of structures | | | ● | | | ● | ● | ● | ● | ● |
| Traffic | ● | ● | ● | ● | ● | ● | ● | ● | ● | |
| **Cumulative Impact Scenario, Other IPFs** | | | | | | | | | | |
| Beach restoration | ● | | | ● | | | | | | ● |

Diverse recreation and tourism activities occur along the Atlantic coast from North Carolina to Florida, including boating, swimming, surfing, diving, sunbathing, wildlife viewing (e.g. dolphin or bird watching), and fishing (note, recreational fishing is discussed in Section 4.3.9). The majority of recreation and tourism activity potentially affected by wind energy development occurs along the coastline or fairly close to shore. A recent BOEM EA considered recreation and tourism activity occurring within 0.25 mi (0.4 km) of the coastline as having the potential to be affected by that proposed action (BOEM 2016c). However, actions occurring farther offshore also can contribute to cumulative impacts on recreation and tourism resources, particularly through visual and noise affects.

The impacts of Atlantic region offshore wind development on tourism and recreation have been the subject of three recent BOEM reports (BOEM 2012b; 2018c; 2019c). Offshore wind development can result in changes to natural resources which can in turn impact recreation (e.g. changes in surfing conditions) or changes in the viewshed which may impact tourism activities (e.g. attracting new visitors or negatively impacting visitation to the area). Depending on the public perception of offshore wind facilities, these impacts can be positive or negative. An offshore wind power project has potential to affect the experience/enjoyment of beachgoers on beach trips, to change trip behavior, as well as to generate “curiosity trips.” Curiosity trips refer to trips taken for the purpose primarily of seeing an offshore wind power project (i.e., a “special trip,” different than a primarily beach-recreation trip.

A 2019 BOEM study of the perceptions of North and South Carolina residents found that residents living near the shoreline (up to 20 miles inland) expect negative impacts to result from offshore wind development (BOEM 2019c). Respondents anticipated negative impacts to daytime ocean views, nighttime ocean views, and bird and marine habitat, which are considered important for recreational purposes. While respondents tend to expect negative impacts, this study also suggests the public is relatively uncertain about indirect impacts of offshore wind development (i.e., non-economic impacts).

The recent stated preference survey found that an offshore wind power project could have negative economic effects on beach recreation for projects near shore (closer than 7.5 miles), especially at larger, more popular beaches. However, a wind project located 12.5 to 20 miles offshore, in many instances was found to result in a net positive effect on recreation (i.e., trip increases and curiosity trips are greater than lost trips) (BOEM 2018c).

IPFs that may interact with wind energy-related IPFs and affect recreation and tourism include: construction/installation and decommissioning; stressors related to the presence of structures both offshore and onshore; light; noise; vessel-derived stressors such as accidental releases of fuel, trash and debris; and vessel traffic. Increased vessel traffic and noise have the potential to change the aesthetics of coastal and offshore areas and to affect recreational activities and tourism (BOEM 2012b). An operating wind facility can change the viewshed on the marine horizon both during the day and at night. Effects depend on the number of turbines, the height and size of the turbines, their distance from shore, and the weather conditions (BOEM 2012b). While the risk of spill effects on recreational resources in the region offshore from North Carolina to Florida may be small, depending on the location of recreation and tourism activity, accidental releases may pose the potential for direct but limited effect on recreational activities (BOEM 2016c). In addition, permitting requirements for various activities such as sand mining, offshore wind, tidal and wave energy development, and pipeline/cable projects would likely be sited and designed to avoid or minimize potential recreational impacts (MMS 2009).

The following subsections discuss the potential IPFs and impacts of each type of activity on recreation and tourism resources.

### *Dredged material ocean disposal*

There are 8 active projects and 8 inactive/closed projects identified in the South Atlantic AOI (Table 3-10). Ocean disposal of dredge material has decreased as beneficial reuse has increased. USACE reported that about 20% to 30% of port and waterway dredged material is used for habitat creation and other beneficial uses (USACE 2012). With increased port expansion/dredging projects to handle post-Panamax vessels, BOEM expects ocean disposal activity to remain stable or increase.

Vessels required for dredging and disposal activities create oceangoing traffic, which can interfere with recreational boating activities. The majority of dumping activity occurs at these designated sites (MMS 2007). Vessel traffic impacts to recreational activities from dredging and disposal activities would be localized and concentrated around these areas. These vessels also may result in accidental releases which have the potential to affect recreation and tourism activities if they preclude activities from occurring or result in oiling or trash along the shoreline at recreation/tourism locations.

### *Commercial and recreational fishing*

Commercial and recreational fishing can affect recreation and tourism through several different IPFs. Vessels conducting fishing activity (both commercial and recreational) can interfere with recreational boating activity. In addition, accidental releases from fishing vessels could occur which have the potential to affect recreation and tourism activities if they preclude recreational activities from occurring or result in oiling or trash along the shoreline at recreation/tourism locations.

### *Land use and coastal infrastructure*

Impacts to recreation and tourism from onshore infrastructure would be related to port utilization and vessel traffic transiting to and from ports. Additional vessel traffic associated with ports could impact recreation and tourism negatively; however, baseline levels of vessel traffic need to be considered when determining the significance of potential cumulative impacts. Some growth in vessel traffic to and from ports would be expected in areas where port expansion is occurring; as of 2019, all principal ports along the Atlantic coast offshore of North Carolina to Florida have planned or ongoing development activities (see Section 3.6 for information on expected port developments). In addition, light associated with industrial facilities in coastal areas may also affect the enjoyment of recreational activities offshore or along the coast through cumulative light pollution.

### *Marine minerals extraction*

Sand and gravel mining along the Atlantic coast offshore of North Carolina to Florida includes use of existing and potential borrow sites where sand mining will occur. Beach restoration associated with this activity has the potential to impact recreation and tourism, either negatively or positively. During the restoration activity, recreation/tourism may be negatively affected; however, once the restoration is complete, this could positively affect recreational experiences.

States also have active minerals mining and channel dredging activities that support numerous local beach renourishment projects. However, the type and availability of data on these projects vary widely at the state and county level. Evaluating the potential interactions with offshore wind energy development and such local projects appears to require real-time effort at state- and county-level offices. The Army Corps of Engineers (USACE 2020).may have the most comprehensive source of information on these local projects at its USACE Jurisdictional Determinations and Permit Decisions website: https://permits.ops.usace.army.mil/orm-public.

Vessel traffic associated with these activities may interfere with recreational boating on a localized basis. In addition, accidental releases from vessels involved in marine minerals mining could occur which have the potential to affect recreation and tourism activities if they preclude recreational activities from occurring or result in oiling or trash along the shoreline at recreation/tourism locations.

### *Marine transportation*

Marine transportation is an ongoing, regular activity that generates substantial vessel traffic in locations along the Atlantic coast from North Carolina to Florida. Close to shore, traffic is concentrated in key shipping channels and port areas (BOEM 2014a). Vessel traffic associated with marine transportation may interfere with recreational boating operating in the same locales. These vessels also may result in accidental releases that can affect recreation and tourism.

### *Military use, military range complexes, civilian space programs*

Recreational activities may be restricted in military range complexes and civilian space program use areas. The Navy's standard operating procedures also require that an area is clear of non-participating vessels and aircraft before an activity using ordnance or expended materials occurs (Navy 2018). Temporary and short duration (hours) impacts may occur from limits on accessibility to marine areas used for recreation; however, most limitations on accessibility are temporary and would be lifted upon completion of training and testing activities (Navy 2018). Similarly, people participating in recreation or tourism activities may experience noise from vessels or aircraft involved in a training or testing activity. These occurrences would likely be of short duration and infrequent, and other than transiting vessels and aircraft, most Navy training and testing that generates airborne noise would occur farther from shore than most recreational and tourism activities (Navy 2018).

Similar to other activities involving vessel traffic, vessels associated with military use and programs have the potential for accidental releases, which have the potential to affect recreation and tourism activities if they preclude recreational activities from occurring or result in oiling or trash along the shoreline at recreation/tourism locations.

### *Oil and gas surveys and extraction*

The Atlantic has seen minimal oil and gas development interest and activity from the 1970s through the present: between 1979 and 1984 eight exploratory wells were drilled with no economically viable discoveries. The current five-year OCS oil and gas lease sale plan has no lease sales scheduled through 2022. Any projections for future leasing in the Atlantic would be speculative. Therefore, the cumulative impact scenario considers only the impacts of G&G activities. When leases sales are conducted, the full list of oil and gas development- related IPFs will need to be assessed.

G&G survey activities are allowable in the region, though restrictions apply to some areas. BOEM has received several permit requests for G&G surveys in support of oil and gas exploration and industry has expressed interest in expanding activities on the Atlantic OCS (BOEM 2019e). Onshore support activities for G&G surveys are expected to be minimal (BOEM, 2014a). G&G surveying activities have the potential to impact recreation and tourism activities, through creation of additional traffic and accidental releases.

If oil and gas development occurs in the future, onshore support activities that could affect tourism and recreation include installation of onshore pipeline infrastructure and support facilities, changes to existing zoning, and construction of roads (BOEM 2016a). These activities would create air emissions from onshore transportation as well as onshore facilities (BOEM 2016a). Onshore discharges associated with liquid wastes would also be expected and survey vessels and other vessels could have accidental fuel or oil spills that affect land use and surrounding communities (BOEM 2014a).

### *Renewable energy development, wind*

Offshore wind energy development has the potential to impact recreation and tourism activity in a variety of ways.

- *Site characterization surveys.* Surveys have the potential to add vessel traffic and which can also result in accidental releases (BOEM 2014a).
- *Installation of meteorological towers and/or meteorological buoys*. Depending on the location of towers/buoys, this may result in interference with recreational boating, or create viewshed or light impacts.
- *Installation/Decommissioning of turbine structures*. This can result in negative effects on recreational activity during installation, due to increased traffic that could interfere with recreational boating, and potential for accidental releases. However, during operations, wind turbines may have a neutral or slightly positive impact on recreation and tourism activity, in both the short and long term depending on public perception.

Cumulative visual impacts could occur to onshore recreational resources from the presence of vessels associated with wind energy construction/installation/decommissioning when combined with the presence of vessels associated with other projects (BOEM 2014b). Whether the presence of structures related to wind energy activities will contribute to cumulative impacts on recreation and tourism depends on the siting of the project; most recreational boating activity occurs closer to shore, and visual impacts will depend on the location of the site in relation to onshore tourism/recreation locations (e.g. see BOEM 2013a: because the WEA was proposed to be located more than 9 nm offshore, no visual impacts on recreational resources were expected). Cumulative impacts could occur if multiple offshore wind energy facilities were sited in close proximity to one another (MMS 2007).

### *Submarine cables, transmission/telecommunication lines, pipelines*

The Atlantic coast offshore of North Carolina to Florida contains minimal existing undersea cable infrastructure. The impacts to recreation and tourism from existing and new submarine cables, transmission/ telecommunication lines, pipelines are related to the vessel traffic associated with installation and O&M. Vessels associated with construction and O&M have the potential to impact recreation and tourism through accidental releases. Installation of submarine cables, transmission/telecommunication lines, and pipelines may create seafloor disturbances, which may impact recreational activities dependent on benthic resources, such as diving. The introduction of many hard-substrate structures in a given area has the potential to displace certain species and alter ecosystems, because species requiring hard substrate could move into the area.

### *Climate change*

As described in Section 3.8, climate change disrupts geophysical and biological resources globally. Climate change will directly or indirectly alter the impacts of IPFs that affect tourism and recreation by affecting the availability and location of recreational resources due to rising sea levels and the potential for more frequent hurricanes which threaten coastal tourist communities. To the degree wind energy development offsets the use of fossil fuel used to generate power, it will reduce carbon emissions and further efforts to reduce global warming.

#### *4.3.3.5 Commercial and Recreational Fishing*

**Table 4-21. Cumulative Impacts Scenario IPFs – Commercial and Recreational Fishing**

| | Dredge Material Ocean Disposal | Commercial and Recreational Fishing | Land Use /Coastal Infrastructure | Marine Minerals Extraction | Marine Transportation, Navigation, and Traffic | Military Ranges & Civilian Space Program Uses | Oil and Gas Surveys and Extraction | Renewable Energy-Wind | Submarine Cables, Lines, & Pipelines | Climate Change |
|---|---|---|---|---|---|---|---|---|---|---|
| **Offshore Wind Energy Development IPFs** | | | | | | | | | | |
| Accidental releases | ● | ● | ● | ● | ● | ● | ● | ● | ● | |
| Air emissions | ● | ● | ● | | ● | ● | ● | ● | ● | |
| Anchoring | | | | | | ● | ● | ● | | |
| Discharges | ● | ● | ● | ● | ● | ● | ● | ● | ● | |
| Energy generation, energy security | | | | | | | | ● | | ● |
| Light | | ● | ● | | ● | ● | ● | ● | | |
| New cable emplacement/maintenance | | | | | | | | ● | ● | ● |
| Noise | ● | ● | ● | ● | ● | ● | ● | ● | ● | |
| Port utilization | ● | | | | ● | | ● | ● | | ● |
| Presence of structures | | | ● | | | ● | ● | ● | ● | ● |
| Traffic | ● | ● | ● | ● | ● | ● | ● | ● | ● | |
| **Cumulative Impact Scenario, Other IPFs** | | | | | | | | | | |
| Beach restoration | ● | | | ● | | | | | | ● |
| Gear utilization | | ● | | ● | | ● | | | | ● |
| Land disturbance | | | ● | | | | ● | | | ● |
| Ocean acidification | | | | | | | | | | ● |
| Pipeline trenching | | | | | | | ● | | | |
| Regulated fishing effort | | ● | | | | | | | | ● |
| Resource exploitation | | ● | | | | | | | | ● |
| Sediment deposition and burial | ● | | | | | | | | | ● |
| Seabed profile alterations | | | | ● | | | | | | ● |
| Warming and sea-level rise | | | | | | | | | | ● |

The Mid-Atlantic Fishery Management Council (MAFMC), the South Atlantic Fishery Management Council (SAFMC), and the Atlantic States Marine Fisheries Commission (ASMFC) manage the nation's fishery resources along the Atlantic coast from North Carolina to Florida. The NOAA Fisheries Southeast Regional Office and the Southeast Fisheries Science Center also inform fisheries management decisions and protect species and habitats in this area. The management area of MAFMC and SAFMC for all federal fisheries includes the U.S. Exclusive Economic Zone (from 3 to 200 nm from the coastline), while the various states oversee state waters (from 0 to 3 nm from the coastline) and ASMFS coordinates the conservation and management of specific nearshore fish species. As such, the focus of the analysis of cumulative impacts to fisheries is likely to be limited to these zones.

A recent study by BOEM indicates that based on federal permit data, an annual average of about $14.0 million in commercial fishing revenue was derived from eight proposed wind energy planning areas (WEAs; including Massachusetts, Rhode Island/Massachusetts, New York, New Jersey, Delaware, Maryland, Virginia, and North Carolina WEAs) annually between 2007 and 2012 (Kirkpatrick et al. 2017). The same 2017 study found that ports in North Carolina's outer banks are among those most exposed in terms of the percentage of total fishing revenue sourced from wind energy areas. With respect to recreational fisheries, in 2018 there were 16.6 million recreational trips in North Carolina, nearly 44.0 million trips in Florida (including both coasts), 4.6 million trips in Georgia, and 9.9 million trips in South Carolina (NOAA 2019c).

Most activities and associated IPFs occurring along the Atlantic coast from North Carolina to Florida have some potential to cumulatively impact commercial and recreational fisheries, as shown in Table 4-1 above. Key factors to be considered include the extent to which (1) the presence of structures may affect the ability of commercial fishing vessels to operate in the vicinity of the wind project, and (2) vessel traffic related to the wind project would affect regional fishing vessel traffic. While most vessels may be able to avoid commercial fishing vessels with gear in the water as they transit to an offshore location, impacts to commercial fisheries from other vessel traffic are important to consider. Air emissions associated with vessel use may also contribute to increased ocean acidification and declines in water quality and fishing conditions.

The following subsections discuss the potential IPFs and impacts of each activity on commercial and recreational fisheries.

### *Dredged material ocean disposal*

There are 8 active projects and 8 inactive/closed projects identified in the South Atlantic AOI (Table 3-10). Ocean disposal of dredge material has decreased as beneficial reuse has increased. USACE reported that about 20% to 30% of port and waterway dredged material is used for habitat creation and other beneficial uses (USACE 2012). With increased port expansion/dredging projects to handle post-Panamax vessels, BOEM expects ocean disposal activity to remain stable or increase.

Vessels required for dredging and disposal activities create oceangoing traffic, which can interfere with fishing activities. The majority of dumping activity occurs at these designated sites (MMS 2007). Vessel traffic impacts to fisheries from dredging and disposal activities would be localized and concentrated around these areas. Dredging and disposal vessel activity also may result in accidental releases and add to chronic noise in the marine environment that can affect fish and associated fisheries. In addition, air emissions associated with vessel use may contribute to increased ocean acidification and declines in water quality and fishing conditions.

### *Commercial and recreational fishing*

In 2017, commercial fisheries harvested approximately 194 million pounds of fish and shellfish in the four-state region (including North Carolina, South Carolina, Georgia and Florida), with a total landed value of over $397 million (2018 dollars); over the period from 2008 to 2017, average annual landings were 190 million pounds with a value of $376 million (NOAA 2019d). The top five species by landing value in 2017 for the four-state region included for the four-state region included white shrimp, blue crab, Caribbean spiny lobster, pink shrimp, and stone crab (NOAA 2019d). Total values and pounds landed over the past ten years are shown in Figure 3-11, based on data from NOAA Fisheries. Between 2008 and 2017, the value of landings ranged from $305 million to $431 million, while landings weight ranged from 179 million pounds to 210 million pounds.

Commercial and recreational fishing regulations limit activity through a variety of closures and gear restrictions designed to support sustainable fisheries and protect threatened and endangered species and marine mammals. Closures and restrictions depend on species, season and location. For example, certain areas are closed to black sea bass pot fishing on an annual basis (SAFMC 2019a). Ongoing trends in fishing are important for analysts to consider in cumulative impacts analyses for wind projects that include fisheries impacts, especially given the prominence of recreational fishing activity along the Atlantic coast from North Carolina to Florida.

For species along the Atlantic coast from North Carolina to Florida, including highly migratory Atlantic species, NMFS has placed eight fish stocks on either or both the overfished list (i.e. stock having a population size that is too low and that jeopardizes the stock’s ability to produce its maximum sustainable yield) or overfishing list (i.e., a stock having a harvest rate higher than the rate that produces its maximum sustainable yield). These species are likely subject to stricter regulations to rebuild the species.

### *Land use and coastal infrastructure*

Impacts to commercial and recreational fisheries from onshore infrastructure would be related to port utilization and vessel traffic transiting to and from ports. Additional vessel traffic associated with ports could impact fishing negatively; however, baseline levels of vessel traffic need to be considered when determining the significance of potential cumulative impacts. Some growth in vessel traffic to and from ports would be expected in areas where port expansion is occurring; as of 2019, all principal ports along the Atlantic coast offshore of North Carolina to Florida have planned or ongoing development activities (see Table 3-27 for expected port developments). In addition, air emissions associated with industrial facilities in coastal areas may also contribute to increased ocean acidification and declines in water quality and fishing conditions.

### *Marine minerals extraction*

Sand and gravel mining along the Atlantic coast from North Carolina to Florida includes use of existing and potential borrow sites where sand mining will occur. Vessel traffic associated with these activities may interfere with commercial fisheries operating in the same locales. Based on technology and cost factors, sand mining activity appears limited to depths less than 30 m (98 ft) (BOEM 2014-001). This may limit potential for interaction with commercial fishing fleets that operate in greater depths. In total, there are three active sites off of the Atlantic coast from North Carolina to Florida, while many others have now closed or expired as of 2019 (see Section 3.3)

States also have active minerals mining and channel dredging activities that support numerous local beach renourishment projects. However, the type and availability of data on these projects vary widely at the state and county level. The Army Corps of Engineers (USACE 2020).may have the most comprehensive source of information on these local projects at its USACE Jurisdictional Determinations and Permit Decisions website: https://permits.ops.usace.army.mil/orm-public.

Vessels associated with marine minerals extraction have the potential to impact fish, and thus fisheries, through accidental releases, discharges or noise. In addition, marine minerals extraction may create seafloor disturbances through use of hopper dredges, which may impact fisheries that are reliant on benthic resources.

### *Marine transportation*

Marine transportation is an ongoing, regular activity that generates substantial vessel traffic in locations along the Atlantic coast offshore of North Carolina to Florida. Close to shore, traffic is concentrated in key shipping channels and port areas (BOEM 2014a). Vessel traffic associated with marine transportation may interfere with commercial fisheries operating in the same locales. Shipping fairways, traffic lanes, anchorage areas, separation, danger, and safety/security zones, and other navigational areas designated to provide safe access routes to and from ports also have an impact in terms of limiting locations where fishing can occur. In particular, there are key shipping channels where larger vessel traffic, such as tanker and cargo vessels, is more concentrated near the coast. These areas are typically lanes leading out from the principal ports along the coast and can be seen in Figure 3-8 in Chapter 3.6.

These vessels also may result in accidental releases and add to chronic noise in the marine environment that can affect fish and associated fisheries. Air emissions associated with vessel use also may contribute to increased ocean acidification and declines in water quality and fishing conditions.

### *Military use, military range complexes, civilian space programs*

Commercial and recreational fishing activities may be restricted in military range complexes and civilian space program use areas. The Navy's standard operating procedures also require that an area is clear of non-participating vessels and aircraft before an activity using ordnance or expended materials occurs (Navy 2018). Temporary and short duration (hours) impacts may occur from limits on accessibility to marine areas used for fishing; however, most limitations on accessibility are temporary and would be lifted upon completion of training and testing activities (Navy 2018). Repetitive and routine training could result in additional impacts. Cumulative impacts would be expected in and adjacent to areas where military training or testing activity occurs (Navy 2018).

Similar to other activities involving vessel traffic, vessels associated with military use and programs have the potential to impact fish, and thus fisheries, through accidental releases, discharges or noise. In addition, air emissions associated with vessel use also may contribute to increased ocean acidification and declines in water quality and fishing conditions.

#### *Oil and gas surveys and extraction*

The Atlantic has seen minimal oil and gas development interest and activity from the 1970s through the present: between 1979 and 1984 eight exploratory wells were drilled with no economically viable discoveries. The current five-year OCS oil and gas lease sale plan has no lease sales scheduled through 2022. Any projections for future leasing in the Atlantic would be speculative. Therefore, the cumulative impact scenario considers only the impacts of G&G activities. When leases sales are conducted, the full list of oil and gas development- related IPFs will need to be assessed.

G&G survey activities are allowable in the region, though restrictions apply to some areas. BOEM has received several permit requests for G&G surveys in support of oil and gas exploration and industry has expressed interest in expanding activities on the Atlantic OCS (BOEM 2019e). Onshore support activities for G&G surveys are expected to be minimal (BOEM, 2014a) and not affect onshore support of commercial and recreational fishing.

G&G surveying activities have the potential to impact fish, and thus commercial and recreational fisheries, through creation of additional traffic, noise, routine discharges, bottom/land disturbance, lighting, and accidental releases. In addition, air emissions associated with operations and vessel use also may contribute to increased ocean acidification and declines in water quality and fishing conditions.

#### *Renewable energy development, wind*

Wind energy development has the potential to impact commercial and recreational fisheries in a variety of ways.

- *Site characterization surveys.* Surveys have the potential to affect commercial and recreational fisheries through active acoustic sound sources, vessel traffic, seafloor disturbance, trash and debris, and accidental releases (BOEM 2014a).
- *Construction/Decommissioning activities*: During construction, target species of commercial and recreational fisheries could be locally displaced due to noise and other disturbances. These impacts would be expected to be localized and short-lived (Kirkpatrick et al. 2017).
- *Installation of meteorological towers and/or meteorological buoys*. Depending on the location of towers/buoys, they may result in reduced availability of fish, and increase the difficulty of catching fish in these areas, especially for certain gear types. These structures present a risk of entanglement for fishing gear.
- *Installation/Decommissioning of turbine structures*. This can result in negative effects on fish populations (such as displacement), and thus fisheries, due to electromagnetic fields and noise, both during construction/decommissioning/removal and operations. However, during operations, turbine structures may serve as fish aggregating devices in a similar manner to other man-made structures such as oil and gas platforms on the OCS (Kirkpatrick et al. 2017; BOEM 2019d). As such, wind turbines may have a neutral or slightly positive impact on recreational fishing activity, in both the short and long term. For commercial fisheries, anecdotal evidence suggests that wind structures

> could prevent highly mobile fishing gear, such as bottom trawls, from fully utilizing the developed area. In addition to anecdotal evidence, recent research identified the spacing and arrangement of turbines as an important consideration for potential effects on commercial fishing as they may impede vessel maneuverability. The same study found that while wind turbines may be built where commercial fishing historically occurs; informal exclusion zones may be created when fishermen choose to avoid wind farms for fear of increased insurance costs or inability to safely navigate the area. (BOEM 2019d). Fishermen may generally avoid WEAs during inclement weather due to the increased risk to safe navigation (Kirkpatrick et al. 2017).

In addition, similar to other activities involving vessel traffic, vessels associated with construction and O&M for wind energy have the potential to impact fish, and thus fisheries, through accidental releases, discharges or noise. Accidental releases of fuel/fluids from service vessels, or spills of other fluids (e.g., dielectric fluids from alternative energy facility electric support platforms) could harm fisheries through fish kills or contamination of large numbers of fish.

### *Submarine cables, transmission/telecommunication lines, pipelines*

The Atlantic coast offshore North Carolina to Florida contains minimal existing undersea cable infrastructure. The impacts to fisheries from existing and new submarine cables, transmission/ telecommunication lines, and pipelines are related to the vessel traffic associated with installation and O&M, as well as risk of entanglement for certain gear types. In addition, dead cables, which have not been removed, pose a risk of entanglement.

Vessels associated with construction and O&M have the potential to impact fish, and thus fisheries, through accidental releases, discharges or noise. Installation of submarine cables, transmission/ telecommunication lines, and pipelines creates seafloor disturbances, which may impact fisheries dependent on species reliance on benthic resources. There is also the potential that during surveys for potential cable routes certain fishing gear will need to be removed, negatively affecting fishing activities in the short-term (Avangrid 2019). Further, the introduction of many hard-substrate structures in a given area has the potential to displace certain species and alter ecosystems, because species requiring hard substrate could move into the area. These impacts could occur for all types of alternative energy facilities and for oil and gas development, LNG facility development, and artificial reef programs (MMS 2007). In addition, air emissions associated with vessel use also may contribute to increased ocean acidification and declines in water quality and fishing conditions.

### *Climate change*

Climate change disrupts geophysical and biological resources globally (see Section 3.8). Climate change will directly or indirectly alter the impacts of IPFs that affect fisheries, including changes in suitable location, prey abundance/availability, and accessibility for commercial fishing vessels if species move to deeper (cooler) waters. To the degree wind energy development offsets the use of fossil fuel used to generate power, it will reduce carbon emissions and further efforts to reduce global warming.

#### *4.3.3.6 Land Use and Infrastructure*

**Table 4-22. Cumulative Impacts Scenario IPFs – Land Use and Infrastructure**

| | Dredge Material Ocean Disposal | Commercial and Recreational Fishing | Land Use /Coastal Infrastructure | Marine Minerals Extraction | Marine Transportation, Navigation, and Traffic | Military Ranges & Civilian Space Program Uses | Oil and Gas Surveys and Extraction | Renewable Energy-Wind | Submarine Cables, Lines, & Pipelines | Climate Change |
|---|---|---|---|---|---|---|---|---|---|---|
| **Offshore Wind Energy Development IPFs** | | | | | | | | | | |
| Accidental releases | ● | ● | ● | ● | ● | ● | ● | ● | ● | |
| Air emissions | ● | ● | ● | | ● | ● | ● | ● | ● | |
| Discharges | ● | ● | ● | ● | ● | ● | ● | ● | ● | |
| Light | | ● | ● | | ● | ● | ● | ● | | |
| Noise | ● | ● | ● | ● | ● | ● | ● | ● | ● | |
| Port utilization | ● | | | | ● | | ● | ● | | ● |
| Presence of structures | | | ● | | | ● | ● | ● | ● | ● |
| Traffic | ● | ● | ● | ● | ● | ● | ● | ● | ● | |
| **Cumulative Impact Scenario, Other IPFs** | | | | | | | | | | |
| Beach restoration | ● | | | ● | | | | | | ● |
| Land disturbance | | | ● | | | | ● | | | ● |
| Warming and sea-level rise | | | | | | | | | | ● |

Offshore activities have some potential to affect onshore land use and coastal infrastructure, particularly due to associated onshore construction activities and in the event of accidental releases. The likelihood of accidental releases is higher in areas with larger ports and vessel activities (BOEM 2015). Some discharges and wastes are also required to be transported and stored onshore (BOEM 2016a). Discharges are largely regulated and where allowed would be likely to dissipate quickly (MMS 2007). For discharges to directly affect coastal land and terrestrial environments would likely require a catastrophic discharge event or major oil spill (BOEM 2016a). Land use and infrastructure are highly local and zoning and planning rules should be examined on a site specific basis.

##### *Dredged material ocean disposal*

There are 8 active projects and 8 inactive/closed projects identified in the South Atlantic AOI (Table 3-10). Ocean disposal of dredge material has decreased as beneficial reuse has increased. USACE reported that about 20% to 30% of port and waterway dredged material is used for habitat creation and other beneficial uses (USACE 2012). With increased port expansion/dredging projects to handle post-Panamax vessels, BOEM expects ocean disposal activity to remain stable or increase.

Vessels required for dredging and disposal activities create oceangoing traffic, which can contribute to port utilization and traffic. The majority of dumping activity occurs at designated sites (MMS 2007). Vessel traffic impacts to land use and infrastructure from dredging and disposal activities would be localized and far from shore. These vessels also may result in accidental releases which have the potential to affect land use if they preclude activities from occurring or result in oiling or trash along the shoreline.

### *Land use and coastal infrastructure*

Land use along the Atlantic coast offshore of North Carolina to Florida is diverse, and includes industrialized ports, large metropolitan areas (including Jacksonville, Savannah, and Charleston among others), large tourist areas, as well as natural areas with a variety of coastal habitats. A network of federal, state and local authorities manages land use and coastal infrastructure to balance conservation of the environment with economic development. These include the CZMA, the National Historic Preservation Act (NHPA), among other state and federal statutes and regulations (BOEM 2016a).

Existing onshore infrastructure as well as construction activities produce air emissions, noise, traffic, and light pollution to varying degrees along the Atlantic coast. Electric grid structures, shipyards, ports and transportation networks are important to the development of offshore alternative energy resources (MMS 2007). However, some sites where these activities occur may already meet the infrastructure needs of South Atlantic OCS energy development (MMS 2007). In addition, onshore facilities are typically sited in previously developed locations when possible. As a result, while development of onshore infrastructure may affect existing land uses to some degree, cumulative effects of new onshore infrastructure from offshore wind energy projects appear likely to be small in most cases. Consistent with this assumption, BOEM's Renewable Energy PEIS identified onshore development of renewable energy on land use and infrastructure as likely to result in negligible impacts (MMS 2007).

### *Military use, military range complexes, civilian space programs*

There are twelve major onshore military installations on the Atlantic coast offshore of North Carolina to Florida (not including U.S. Coast Guard facilities) that undertake a wide variety of activities, including sheltering military personnel, as well as facilitating training and operations. A number of U.S. military installations support coastal and offshore training activities (Navy 2018). Navy activities are often supported onshore by commercial shipbuilding facilities (Navy 2018). While most military installations are permanent facilities, temporary structures can also be used in training activities onshore, such as tent encampments (Navy 2018). The Atlantic Fleet Training and Testing EIS (Navy 2018) did not consider land use as it did not require any new actions and was deemed not connected to the resource (Navy 2018). Offshore, similar to other activities, vessels have the potential for spills of fuel or fluids which could affect onshore habitats and land use. In addition, Kennedy Space Center activities could affect onshore habitats and land use if civilian space programs grow requiring additional structures generating various IPFs.

### *Oil and gas surveys and extraction*

The Atlantic has seen minimal oil and gas development interest and activity from the 1970s through the present: between 1979 and 1984 eight exploratory wells were drilled with no economically viable discoveries. The current five-year OCS oil and gas lease sale plan has no lease sales scheduled through 2022. Any projections for future leasing in the Atlantic would be speculative. Therefore, the cumulative impact scenario considers only the impacts of G&G activities. When leases sales are conducted, the full list of oil and gas development- related IPFs will need to be assessed.

G&G survey activities are allowable in the region, though restrictions apply to some areas. BOEM has received several permit requests for G&G surveys in support of oil and gas exploration and industry has expressed interest in expanding activities on the Atlantic OCS (BOEM 2019e). Onshore support activities for surveys are expected to be minimal (BOEM, 2014a).

If oil and gas development occurs in the future, onshore support activities could include installation of onshore pipeline infrastructure and support facilities, changes to existing zoning, and construction of roads (BOEM 2016a). These activities would create air emissions from onshore transportation as well as onshore facilities (BOEM 2016a). Onshore discharges associated with liquid wastes would also be expected and survey vessels and other vessels could have accidental fuel or oil spills that affect land use and surrounding communities (BOEM 2014a).

### *Renewable energy development, wind*

Wind energy development has the potential to affect existing land use and infrastructure primarily through infrastructure demand. Wind energy developments have the potential for larger structures with more land required than tidal energy developments, although general activities onshore including construction, staging and maintenance activities are similar (MMS 2007). Impacts of onshore infrastructure for wind energy development projects may include short-term impacts to air emissions from vehicles, fugitive dust, as well as longer term lighting and noise effects. Cumulative impacts analyses of wind energy projects on land use and infrastructure should consider whether onshore facilities for other wind energy projects occur in the vicinity of proposed facilities and the magnitude of potential onshore facility upgrades to accommodate wind energy activities.

### *Submarine cables, transmission/telecommunication lines, pipelines*

There are few seabed cables for the telecommunications industry on the Atlantic coast offshore of North Carolina to Florida. Development of permanent facilities for offshore wind has the potential to affect existing cables through bottom disturbances for construction as well as laying of new cables to support wind activities. To the extent that catastrophic accidents associated with pipelines occur, impacts to land use and infrastructure could occur. The impact of these activities on coastal land use and other infrastructure would be limited, primarily related to the landing sites where cables connect to onshore infrastructure. Impacts of onshore facilities that connect to these features are addressed under the land use and coastal infrastructure category.

### *Climate change*

As described in Section 3.8, climate change disrupts geophysical and biological resources around the world. Climate change will directly or indirectly alter the impacts of IPFs that affect land use and infrastructure through changing coastlines, more frequent hurricanes, flooding, and construction projects designed to contain rising sea levels. To the degree wind energy development offsets the use of fossil fuel used to generate power, it will reduce carbon emissions and further efforts to reduce global warming.

#### *4.3.3.7 Military Range Complexes and Civilian Space Program Uses*

**Table 4-23. Cumulative Impacts Scenario IPFs – Military Range Complexes & Civilian Space Program Uses**

| | Dredge Material Ocean Disposal | Commercial and Recreational Fishing | Land Use /Coastal Infrastructure | Marine Minerals Extraction | Marine Transportation, Navigation, and Traffic | Military Ranges & Civilian Space Program Uses | Oil and Gas Surveys and Extraction | Renewable Energy-Wind | Submarine Cables, Lines, & Pipelines | Climate Change |
|---|---|---|---|---|---|---|---|---|---|---|
| **Offshore Wind Energy Development IPFs** | | | | | | | | | | |
| Accidental releases | ● | ● | ● | ● | ● | ● | ● | ● | ● | |
| Presence of structures | | | ● | | | ● | ● | ● | ● | ● |
| Traffic | ● | ● | ● | ● | ● | ● | ● | ● | ● | |
| **Cumulative Impact Scenario, Other IPFs** | | | | | | | | | | |
| Guidance/fiber optic wires, entanglement | | | | | | ● | | | | |
| Warming and sea-level rise | | | | | | | | | | ● |

As described in Section 3.5, there are numerous military range complexes and civilian space use areas established along the Atlantic coast from North Carolina to Florida. Restricted areas and danger zones are established in areas off U.S. coastlines to allow military forces to conduct training and testing activities. Portions of these areas can be closed or subject to limited public access at certain times to protect the public or to provide security for government property. NASA also has designated danger zones downrange from the Kennedy Space Center and has identified patterns for recent debris cones from rocket tests that represent hazards for surface activities after testing occurs. In addition, certain activities (e.g., commercial and recreational fishing, oil and gas production, laying of submarine cables) may be restricted in some military use areas. The focus of the analysis of cumulative impacts to military and civilian space uses includes impacts on airspace, surface, and subsea areas that are utilized by military entities, NASA or civilian space companies in the region.

Military uses of the offshore sea and air areas are generally compatible with other vessel and aircraft use; however, where naval vessels and aircraft conduct operations that are not compatible with commercial or recreational transportation, they are confined to Operating Areas (OPAREAs) away from commercially used waterways and inside Special Use Airspace (SUA). To ensure safety, hazardous operations are communicated to all vessels and operators by use of Notices to Mariners issued by USCG and Notices to Airmen issued by the FAA.

Commercial wind energy developments have the potential for space use conflicts with military use areas because of the potentially large areas of the ocean that such developments could occupy (e.g., the area of a commercial wind facility along the Eastern seaboard is most likely between 50 to 148 acres/MW) (DOE 2015). In addition, wind energy developments could impact the use of military radar because the rotor height may exceed 125 m (400 ft) (DOE 2015). Such impacts to military uses would be additive if multiple wind energy developments were in a fairly small geographic area. Under the assumption that the siting of offshore wind energy development is coordinated with the U.S. Department of Defense (DOD) and NASA, cumulative impacts on military and civilian space use areas associated with offshore wind projects are generally anticipated to be limited.

As discussed in the following subsections, limited impacts to military and civilian space use would be related to the activities and associated IPFs occurring off the Atlantic coast offshore of North Carolina to Florida shown in Table 4-1 above. Key factors to be considered include the extent to which additional tall structures installed as part of the wind development may affect military radar use, and the extent to which additional vessel traffic or accidental releases related to wind energy developments may interfere with military or civilian space use activities.

### *Dredged material ocean disposal; Commercial and recreational fishing; Marine minerals extraction; Marine transportation/navigation; Oil and gas; and Submarine lines, cables, and pipelines*

Dredged material disposal, commercial and recreational fishing, marine minerals, marine transportation/ navigation, oil and gas, and seabed lines/cables/pipelines all generate traffic (vessel or aircraft or both) to varying degrees, which has the potential to interfere with military or civilian space program activities. Impacts on military activities in the designated OPAREA and aviation from routine activities may occur as a result of increased vessel traffic (BOEM 2013b).

States also have active minerals mining and channel dredging activities that support numerous local beach renourishment projects. However, the type and availability of data on these projects vary widely at the state and county level. The Army Corps of Engineers (USACE 2020).may have the most comprehensive source of information on these local projects at its USACE Jurisdictional Determinations and Permit Decisions website:(https://permits.ops.usace.army.mil/orm-public.

While there are high levels of vessel activity associated with shipping and marine transportation and other activities around ports along the U.S. coastline from North Carolina to Florida, impacts to military as well as civilian space program activities are likely to be modest. This is because areas used for military testing and training include established restricted areas and danger zones which can be closed or subject to limited public access at certain times to protect the public or to provide security for government property.

Thus, interactions between vessel traffic and military activities are already largely controlled. Any activities that may directly or indirectly affect military activities will likely involve consultation with DOD to determine the extent of potential impacts and may result in specific DOD requirements, recommendations, or further mitigation measures necessary to eliminate or reduce potential impacts on military activities (BOEM 2013b). Figure 3-6 in Chapter 3.5 presents the areas that are currently restricted or designated for military use to some degree while Figure 3-8 in Chapter 3.6 presents vessel traffic patterns.

In addition to impacts from vessel or aircraft traffic, accidental releases such as fuel spills related to vessels traversing the area have the potential to impact military activities. All vessel movements are associated with a risk of collision and subsequent loss of fuel. Depending on the extent of the accidental release, military or civilian space program use activities could be affected if areas were considered unusable due to an accidental release. However, increased incidence of such spills related to proposed wind development activities are anticipated to be minimal.

Several activities have the potential for space use conflicts with military activities, including fisheries, marine transportation/navigation, oil and gas, tidal energy, and seabed lines/cables/pipelines. Whether conflicts would occur would depend on the site-specific location and size of activities.

### *Renewable energy development, wind*

BOEM currently has one active lease along the Atlantic coast from North Carolina to Florida (refer to Section 3.1 for additional details). Wind energy development may affect military use and civilian space program use through vessel traffic and the presence of structures, as follows.

- *Site characterization surveys*. Surveys have the potential to affect military and civilian space use primarily through vessel traffic (BOEM 2014a).
- *Installation of meteorological towers and/or meteorological buoys*. Towers/buoys may affect vessel transit routes for military vessels. However, the effects would be highly localized.

- *Installation/Decommissioning of turbine structures.* Turbine structures may also affect vessel transit routes, but again, the effects on military vessels in transit would be highly localized.

It is not anticipated that installation of meteorological towers or wind turbines would interfere with military activities (BOEM 2013b). In general, impacts from wind energy development on military activity would be expected to be highly localized. Vessel traffic within military range complexes and civilian space program use areas would increase due to activities related to wind energy development; however, the level of vessel traffic likely to be generated would be relatively minor when compared with existing vessel traffic from commercial shipping, personal recreational vessels, passenger vessels, military vessels, and commercial/recreational fishing vessels. The establishment of vessel exclusion zones as part of wind energy development activities could result in incremental increases in impacts to military range complexes and civilian space program uses if traffic is rerouted.

Offshore wind energy development has the potential for space program use conflicts with military activities depending on the size of a proposed project. However, coordination with DOD during the siting process would be expected to minimize multiple use conflicts.

### *Climate change*

Climate change disrupts geophysical and biological resources globally (see Section 3.8). Climate change will directly or indirectly alter the impacts of IPFs that affect military range complexes and civilian space program uses through changing coastlines, the need for coastal base alterations (construction), and global instability caused by more frequent violent weather events. To the degree wind energy development offsets the use of fossil fuel used to generate power, it will reduce carbon emissions and further efforts to reduce global warming.

#### *4.3.3.8 Marine Transportation, Navigation and Traffic*

**Table 4-24. Cumulative Impacts Scenario IPFs – Marine Transportation, Navigation, and Traffic**

| | Dredge Material Ocean Disposal | Commercial and Recreational Fishing | Land Use /Coastal Infrastructure | Marine Minerals Extraction | Marine Transportation, Navigation, and Traffic | Military Ranges & Civilian | Oil and Gas Surveys and Extraction | Renewable Energy-Wind | Submarine Cables, Lines, & Pipelines | Climate Change |
|---|---|---|---|---|---|---|---|---|---|---|
| **Offshore Wind Energy Development IPFs** | | | | | | | | | | |
| Anchoring | | | | | | ● | ● | ● | | |
| New cable emplacement/maintenance | | | | | | | | ● | ● | ● |
| Port utilization | ● | | | | ● | | ● | ● | | ● |
| Presence of structures | | | ● | | | ● | ● | ● | ● | ● |
| Traffic | ● | ● | ● | ● | ● | ● | ● | ● | ● | |
| **Cumulative Impact Scenario, Other IPFs** | | | | | | | | | | |
| Demolition, structure removal | | | | | | ● | ● | | | |
| Gear utilization | | ● | | ● | | ● | | | | ● |
| Guidance/fiber optic wires, entanglement | | | | | | ● | | | | |
| Port utilization, maintenance, dredging | ● | | | | | | | | | ● |
| Pipeline trenching | | | | | | | ● | | | |
| Regulated fishing effort | | ● | | | | | | | | ● |

Marine transportation in the South Atlantic region is diverse, with vessels originating from numerous ports and private harbors within the South Atlantic, as well as elsewhere in the U.S and internationally. Commercial traffic in the South Atlantic includes commercial fishing, passenger vessels (e.g., cruise ships, ferries), cargo, tug/barge, liquid tanker, military or military training, research, dredging/underwater/diving operations, and search-and-rescue vessels. Recreational traffic includes pleasure, sailing, charter, recreational fishing, and high-speed craft (USCG 2007). Close to shore, traffic is concentrated in key shipping channels and port areas, particularly for larger vessels such as tankers or cargo vessels (BOEM 2014a). Many vessel types, such as ferries and personal craft, generally remain within State waters (MMS 2007). In offshore federal waters, transit routes are numerous and varied. Thus, the analysis of cumulative impacts to marine transportation should consider the entire area off the Atlantic coast from North Carolina to Florida. Additional discussion of marine transportation is provided in Section 3.6.

A recent (2019) BOEM report provides additional information and catalogs literature on the potential interactions between navigation activities and offshore wind energy development (2019d). This study examined five topic areas (policy and guidance, navigational risk, collisions and allisions, commercial fishing, and recreational fishing) and could provide analysts with the current state of research on the overlap of navigation activities and wind energy development. Expert interviews conducted for the study identified a lack of research on the cumulative effects of wind energy development and noted that uncertainty exists regarding the potential cumulative impacts to navigation such as radar interference (BOEM 2019d). These experts also expressed a preference for holistic approaches to siting wind energy development and recommended cumulative analyses of navigational effects. The study also noted disagreement between stakeholder groups on the magnitude of risk and recommended BOEM coordinate across stakeholders for various activities that involve marine traffic that could overlap wind energy development (the following sub sections discuss each activity specifically).

Most activities and associated IPFs (e.g., construction/installation, G&G surveys, new cable emplacement and maintenance) occurring offshore from North Carolina to Florida have some potential to impact marine transportation, navigation, and traffic, as shown in Table 4-1 above. The factors that are most likely to have cumulative impacts on marine transportation are vessel traffic (traffic IPF) and the presence of structures (presence of structures IPF). Vessel traffic and the presence of structures can increase the risk of collisions and allisions, which can result in loss of the structures or vessels, as well as loss of life and spill of diesel fuel or other cargo material (e.g., crude oil) (BOEM 2012a). The highest navigational risk related to offshore wind energy is often during the construction phase with more vessel traffic occurring due to increased supply and support vessels (BOEM 2019d). Wind turbines, once installed, may also act as aids to navigation to help avoid collisions (BOEM 2019d). Navigational risk is typically highest in areas with dense traffic close to ports (BOEM 2019d).

Collisions and allisions are generally considered unlikely because vessel traffic is typically controlled by multiple routing measures, such as safety fairways, traffic separation schemes (TSS), and anchorages (BOEM 2012a). There has been recent development in policy and guidance, including revised U.S. Coast Guard guidance in August 2019, that states that developers should analyze cumulative impacts when WEAs or other offshore renewable energy developments are in close proximity (USCG 2019). The Coast Guard guidance also recommends that wind energy developers conduct a Navigational Safety Risk Assessment (NSRA) as part of permitting and provides guidance on how to conduct and review this guidance (USCG 2019).

Recent research also indicates that there is some potential for increased risk when mixing different vessel types in narrower areas (BOEM 2019d), The highest risks of collisions (loss of steering and/or power) are largely due to human error (BOEM 2019d). Allisions can occur due to a variety of errors as well as environmental factors such as wind or weather. Vessel traffic and the presence of structures can also result in vessel maneuvering and potential traffic inefficiencies and delays. Larger vessels may have limited ability to maneuver, while smaller vessels may sustain more damage from collisions and allisions.

Cumulative impact evaluations should consider the relative volume of traffic from a proposed activity compared to existing traffic and whether the proposed activity (specifically, traffic or structures from the proposed activity) is likely to disrupt popular transit routes. (These analyses are typically provided in a traffic study supporting permit applications.) In addition, particular focus should be on transit routes nearby major ports and narrow sea areas where dense traffic may occur and increase the cumulative potential for navigational risks (BOEM 2019d). Measures for proposed activities that would minimize the cumulative impacts to marine transportation include designs that do not interfere with designated fairways and shipping lanes, and appropriate signage and/or lighting to warn passing vessels (MMS 2007). When these criteria are met, cumulative impacts are expected to be minor.

The following subsections discuss the potential IPFs and impacts of each activity on marine transportation.

### *Dredged material ocean disposal*

There are 8 active projects and 8 inactive/closed projects identified in the South Atlantic AOI (Table 3-10). Ocean disposal of dredge material has decreased as beneficial reuse has increased. USACE reported that about 20% to 30% of port and waterway dredged material is used for habitat creation and other beneficial uses (USACE 2012). With increased port expansion/dredging projects to handle post-Panamax vessels, BOEM expects ocean disposal activity to remain stable or increase.

Vessels required for dredging and disposal activities create oceangoing traffic, which can interfere with marine transportation. The majority of dumping activity occurs at these designated sites (MMS 2007). Impacts to marine transportation from dredging and disposal activities would be localized and concentrated around these areas and common routes to these areas (e.g., from harbors during major dredging activities).

### *Commercial and recreational fishing*

Commercial and recreational fishing activities affect marine transportation through vessel traffic. Fishing closures and restrictions may minimize impacts to marine transportation in the areas of the closures, which can also vary by season. Recreational fishing activity, and associated vessel traffic, is prominent along the Atlantic coast from North Carolina to Florida. Ongoing trends in fishing (including routes, frequency of trips, closure areas, and seasonal patterns) should be considered in cumulative impacts analyses for wind projects.

### *Land use and coastal infrastructure*

Impacts to marine transportation from onshore infrastructure would be related to port utilization and vessels transiting to and from ports. Some growth in vessel traffic to and from ports would be expected in areas where port expansion is occurring; as of 2019, all principal ports along the Atlantic coast of North Carolina to Florida have planned or ongoing development activities (see Table 3-25 for expected port developments).

### *Marine minerals extraction*

Sand and gravel mining along the Atlantic coast offshore of North Carolina to Florida includes use of existing and potential borrow sites where sand mining will occur. Vessel traffic associated with these activities may interfere with existing marine transportation operating in the same locales. Based on technology and cost factors, sand mining activity appears limited to depths less than 30 m (98 ft) (BOEM 2014a), which would limit interaction with existing marine transportation to these areas. In general, the impacts of marine minerals extraction on marine transportation are expected to be minor.

States also have active minerals mining and channel dredging activities that support numerous local beach renourishment projects. However, the type and availability of data on these projects vary widely at the state and county level. The Army Corps of Engineers (USACE 2020).may have the most comprehensive source of information on these local projects at its USACE Jurisdictional Determinations and Permit Decisions website: https://permits.ops.usace.army.mil/orm-public.

### *Marine transportation*

Marine transportation is an ongoing, regular activity that generates substantial vessel traffic in locations along the Atlantic coast offshore of North Carolina to Florida. Additional marine transportation will affect existing marine transportation. As noted in the discussion of other activities in Section 3.6, many activities contribute to vessel traffic. Cumulative impact evaluations should consider the relative contribution of vessel traffic from proposed wind projects compared to existing traffic, as the anticipated increase in vessel traffic from wind energy projects is anticipated to be minor.

### *Military use, military range complexes, civilian space programs*

Marine transportation may be restricted in military range complexes and civilian space program use areas, which can include designated danger zones, restricted areas, and closure areas that may limit access by vessel traffic. In some cases, areas may be closed temporarily to all vessel traffic for military or safety reasons (BOEM 2016c). The Navy's standard operating procedures also require that an area is clear of non-participating vessels and aircraft before an activity using ordnance or expended materials occurs (Navy 2018). Temporary and short duration (hours) impacts may occur from limits on accessibility to marine transit routes; however, most limitations on accessibility are temporary and would be lifted upon completion of training and testing activities (Navy 2018). Repetitive and routine training could result in additional impacts. Cumulative impacts would be expected in and adjacent to areas where military training or testing activity occurs (Navy 2018).

### *Oil and gas surveys and extraction*

The Atlantic has seen minimal oil and gas development interest and activity from the 1970s through the present: between 1979 and 1984 eight exploratory wells were drilled with no economically viable discoveries. The current five-year OCS oil and gas lease sale plan has no lease sales scheduled through 2022. Any projections for future leasing in the Atlantic would be speculative. Therefore, the cumulative impact scenario considers only the impacts of G&G activities. When leases sales are conducted, the full list of oil and gas development- related IPFs will need to be assessed.

G&G survey activities are allowable in the region, though restrictions apply to some areas. BOEM has received several permit requests for G&G surveys in support of oil and gas exploration and industry has expressed interest in expanding activities on the Atlantic OCS (BOEM 2019e). G&G surveying activities have the potential to impact marine transportation through additional traffic. These activities are generally infrequent and localized and are expected to have minor impacts on marine transportation. BOEM’s Draft Proposed Program for the 2019-2024 New National OCS Program proposed to open the entire Atlantic OCS to oil and gas leasing. There are currently no petroleum platforms or pipeline production systems in the area offshore of North Carolina to Florida (BOEM 2014a).

### *Renewable energy development, wind*

Wind energy development could affect marine transportation through vessel traffic and the presence of structures, as follows.

- *Site characterization surveys*. Surveys have the potential to affect marine transportation primarily through vessel traffic (BOEM 2014a).
- *Installation of meteorological towers and/or meteorological buoys*. Towers/buoys may affect vessel transit routes. However, the effects would be highly localized.
- *Installation/Decommissioning of turbine structures*. Turbine structures may affect vessel transit routes, but the effects would be highly localized. The decommissioning and removal of turbine structures may also affect vessel traffic and limit activities.

Impacts from wind energy development on marine transportation would generally be highly localized.

### *Submarine cables, transmission/telecommunication lines, pipelines*

The Atlantic coast offshore of North Carolina to Florida contains minimal existing undersea cable infrastructure (see Section 3.12). Marine transportation may be affected by the installation and O&M of this infrastructure, including submarine cables, transmission/telecommunication lines, and pipelines, which would necessitate vessels and heavy equipment (MMS 2007). However, impacts on marine transportation are generally expected to be localized and minor given the few existing cables and planned cables.

### *Climate change*

As described in Section 3.8, climate change disrupts geophysical and biological resources around the world. Climate change will directly or indirectly alter the impacts of IPFs that affect marine transportation, navigation, and traffic by altering navigation routes due to changing coastal configurations and the possible need to conduct more cargo transfer offshore should ports need to be reconfigured due to higher sea levels. To the degree wind energy development offsets the use of fossil fuel used to generate power, it will reduce carbon emissions and further efforts to reduce global warming.

### 4.3.2.9 Energy Production and Distribution

**Table 4-25. Cumulative Impacts Scenario IPFs – Energy Production & Distribution**

| | Dredge Material Ocean Disposal | Commercial and Recreational Fishing | Land Use /Coastal Infrastructure | Marine Minerals Extraction | Marine Transportation, Navigation, and Traffic | Military Ranges & Civilian Space Program Uses | Oil and Gas Surveys and Extraction | Renewable Energy-Wind | Submarine Cables, Lines, & Pipelines | Climate Change |
|---|---|---|---|---|---|---|---|---|---|---|
| **Offshore Wind Energy Development IPFs** | | | | | | | | | | |
| Energy generation, energy security | | | | | | | | ● | | ● |
| New cable emplacement/maintenance | | | | | | | | ● | ● | ● |
| Port utilization | ● | | | | ● | | ● | ● | | ● |
| Presence of structures | | | ● | | | ● | ● | ● | ● | ● |
| Traffic | ● | ● | ● | ● | ● | ● | ● | ● | ● | |
| **Cumulative Impact Scenario, Other IPFs** | | | | | | | | | | |
| Demolition/structure removal | | | | | | ● | ● | | | |
| Energy stressors/devices/lasers | | | | | | ● | | | | |
| Pipeline trenching | | | | | | | ● | | | |
| Warming and sea-level rise | | | | | | | | | | ● |

Energy production and distribution refers to hydrocarbon energy projects, which could include geophysical surveys; drilling of oil and natural gas exploration, development, and production wells; installation and operation of offshore platforms and pipelines, onshore pipelines, and support facilities; transport of hydrocarbons using pipelines or tankers to processing locations; and decommissioning (BOEM 2016a). At present, no active OCS oil and gas leases exist in any of the four BOEM OCS planning areas in the Atlantic, and no oil and gas lease sales are proposed under the current Five-Year Leasing Program 2012-2017 (BOEM 2016a). There are currently no petroleum platforms or pipeline production systems in the area offshore of North Carolina to Florida (BOEM 2014a).

BOEM released an EIS that evaluated potential effects of G&G surveying activities on the Atlantic OCS in 2014. BOEM has received several permit requests for G&G surveys in support of oil and gas exploration, and industry has expressed interest in expanding activities into Atlantic offshore waters (BOEM 2019e). G&G surveys require vessels and on-water equipment. Additionally, there is one existing and two proposed onshore LNG terminals in the South Atlantic, which result in the transiting of LNG carriers and support vessels. Because of the wide range of types and locations of energy production and distribution elements, the analysis of cumulative impacts to this resource should consider the entire area off the Atlantic coast from North Carolina to Florida. Additional discussion of oil and gas activity is provided in Section 3.9.

Most activities and associated IPFs occurring offshore from North Carolina to Florida have some potential to impact energy production and distribution, as shown in Table 4-1 above. The factors that are most likely to have cumulative impacts on energy production and distribution are vessel traffic (traffic IPF), the presence of structures (presence of structures IPF), and space use conflicts (space use conflicts IPF). However, these factors are expected to typically have only minor impacts on energy production and distribution, based on frequency and the implementation of best practices.

The majority of the activities in Table 4-1 have the potential to result in increased vessel traffic, and vessel traffic also is associated with most of the IPFs (e.g., construction/installation, G&G surveys, new cable emplacement and maintenance). Vessel traffic and the presence of structures can increase the risk of collisions and allisions (vessel accidents with stationary vessels or objects) with energy production and distribution vessels and equipment, which can result in loss of the structures or vessels, as well as loss of life and spills of diesel fuel or other cargo material (e.g., crude oil) (BOEM 2012a). Collisions and allisions are generally considered unlikely because vessel traffic is typically controlled by multiple routing measures, such as safety fairways, TSS, and anchorages (BOEM 2012a). Vessel traffic and the presence of structures also can result in vessel maneuvering and potential traffic inefficiencies and delays, as well as potential disruptions to survey activities. Larger vessels may have limited ability to maneuver, while smaller vessels may sustain more damage from collisions and allisions.

Cumulative impact evaluations should consider the relative volume of traffic from a proposed activity compared to existing traffic and on-water work from energy production and distribution and whether the proposed activity (specifically, traffic or structures from the proposed activity) is likely to disrupt popular transit routes. Measures for proposed activities that would minimize the cumulative impacts to energy production and distribution include locations that are removed from known energy production and distribution sites (e.g., offshore LNG terminals), designs that do not interfere with designated fairways and shipping lanes, and appropriate signage and/or lighting to warn passing vessels (USCG 2016). When these criteria are met, cumulative impacts on energy production and distribution are expected to be minor to negligible.

The following subsections discuss the potential IPFs and impacts of each activity on energy production and distribution.

#### *Dredged material ocean disposal*

There are 8 active projects and 8 inactive/closed projects identified in the South Atlantic AOI (Table 3-10). Ocean disposal of dredge material has decreased as beneficial reuse has increased. USACE reported that about 20% to 30% of port and waterway dredged material is used for habitat creation and other beneficial uses (USACE 2012). With increased port expansion/dredging projects to handle post-Panamax vessels, BOEM expects ocean disposal activity to remain stable or increase.

Vessels required for dredging and disposal activities create oceangoing traffic, which can interfere with energy production and distribution. Designated disposal sites also can create space-use conflicts with energy production and distribution activities. The majority of dumping activity occurs at these designated sites (MMS 2007). Impacts to energy production and distribution from dredging and disposal activities would be localized and concentrated around these areas and common routes to these areas (e.g., from harbors during major dredging activities).

#### *Commercial and recreational fishing*

Fishing vessel traffic and other fishing activities have the potential to affect energy production and distribution. Fishing closures and restrictions may minimize impacts to energy production and distribution in the areas of the closures, which can also vary by season. Ongoing trends in fisheries (including routes, frequency of trips, closure areas, and seasonal patterns) should be considered in cumulative impacts analyses for wind projects.

#### *Land use and coastal infrastructure*

Impacts to energy production and distribution from onshore infrastructure would be related to port utilization, vessels transiting to and from ports, and space-use conflicts with onshore oil and gas terminals and infrastructure. Some growth in vessel traffic to and from ports would be expected in areas where port expansion is occurring; as of 2019, all principal ports along the Atlantic coast of North Carolina to Florida have planned or ongoing development activities (see Chapter 3.11 for a table illustrating expected port developments).

### *Marine minerals extraction*

Sand and gravel mining along the Atlantic coast offshore of North Carolina to Florida includes use of existing and potential borrow sites where sand mining will occur. Vessel traffic and dredging associated with these activities may interfere with energy production and distribution in the same locales, and areas leased for marine minerals extraction would not be available for oil and gas activities.

States also have active minerals mining and channel dredging activities that support numerous local beach renourishment projects. However, the type and availability of data on these projects vary widely at the state and county level. The Army Corps of Engineers (USACE 2020).may have the most comprehensive source of information on these local projects at its USACE Jurisdictional Determinations and Permit Decisions website: https://permits.ops.usace.army.mil/orm-public.

Based on technology and cost factors, sand mining activity appears limited to depths less than 30 m (98 ft) (BOEM 2014a), which would limit interaction with energy production and distribution to these areas. In general, the impacts of marine minerals extraction on energy production and distribution are expected to be minor.

### *Marine transportation*

Marine transportation is an ongoing, regular activity that generates substantial vessel traffic in locations along the Atlantic coast offshore of North Carolina to Florida. Marine transportation has the potential to affect energy production and distribution. As noted above, many activities contribute to vessel traffic. Cumulative impact evaluations for energy production and distribution should consider the relative contribution of vessel traffic from proposed activities compared to existing traffic, as the anticipated increase in vessel traffic may be minor.

### *Military use, military range complexes, civilian space programs*

Energy production and distribution may be restricted in military range complexes and civilian space program use areas, which can include designated danger zones, restricted areas, and closure areas that may limit access by vessel traffic. In some cases, areas may be closed temporarily to all vessel traffic for military or safety reasons (BOEM 2016c). The Navy's standard operating procedures also require that an area is clear of non-participating vessels and aircraft before an activity using ordnance or expended materials occurs (Navy 2018). Temporary and short duration impacts (hours) may occur from limits on accessibility to marine transit routes; however, most limitations on accessibility are temporary and would be lifted upon completion of training and testing activities (Navy 2018). Repetitive and routine training could result in additional impacts. Cumulative impacts would be expected in and adjacent to areas where military training or testing activity occurs (Navy 2018).

### *Oil and gas surveys and extraction*

The Atlantic has seen minimal oil and gas development interest and activity from the 1970s through the present: between 1979 and 1984 eight exploratory wells were drilled with no economically viable discoveries. The current five-year OCS oil and gas lease sale plan has no lease sales scheduled through 2022. Any projections for future leasing in the Atlantic would be speculative. Therefore, the cumulative impact scenario considers only the impacts of G&G activities. When leases sales are conducted, the full list of oil and gas development- related IPFs will need to be assessed.

G&G survey activities are allowable in the region, though restrictions apply to some areas. BOEM has received several permit requests for G&G surveys in support of oil and gas exploration and industry has expressed interest in expanding activities on the Atlantic OCS (BOEM 2019e). Onshore support activities for surveys are expected to be minimal (BOEM, 2014a).

G&G surveying activities have the potential to impact energy production and distribution through additional traffic and space-use conflicts. These activities are generally infrequent and localized and are expected to have minor impacts on energy production and distribution.

If oil and gas development occurs in the future, onshore support activities that could affect energy production and distribution include installation of onshore pipeline infrastructure and support facilities, changes to existing zoning, and construction of roads (BOEM 2016a). These activities would create air emissions from onshore transportation as well as onshore facilities (BOEM 2016a). Onshore discharges associated with liquid wastes would also be expected and survey vessels and other vessels could have accidental fuel or oil spills that affect land use and surrounding communities (BOEM 2014a).

### Renewable energy development, wind

Wind energy development could affect energy production and distribution through vessel traffic, presence of structures, and space-use conflicts, as follows.

- *Site characterization surveys.* Surveys have the potential to affect energy production and distribution, primarily through vessel traffic (BOEM 2014a).
- *Installation of meteorological towers and/or meteorological buoys.* Towers/buoys may affect vessel transit routes and limit energy activities through space-use conflicts. However, the effects would be highly localized.
- *Installation/Decommissioning of turbine structures*. Turbine structures may affect vessel transit routes and limit energy activities through space-use conflicts. The decommissioning and removal of turbine structures may also affect vessel traffic and limit activities.

Impacts from wind energy development on energy production and distribution would generally be highly localized.

### Submarine cables, transmission/telecommunication lines, pipelines

The Atlantic coast offshore of North Carolina to Florida contains minimal existing undersea cable infrastructure relative to the North Atlantic (see Section 3.12). Energy production and distribution may be affected by the installation and O&M of this infrastructure, including submarine cables, transmission/telecommunication lines, and pipelines, which would necessitate vessels and heavy equipment and would result in vessel traffic and potential space-use conflicts (MMS 2007). However, impacts are expected to be minor.

### Climate change

Climate change disrupts geophysical and biological resources around the world (see Section 3.8). Climate change will directly or indirectly alter the impacts of IPFs that affect energy production and distribution by increasing the demand for energy and thereby increasing the need to develop more offshore energy sources. To the degree wind energy development offsets the use of fossil fuel used to generate power, it will reduce carbon emissions and further efforts to reduce global warming.

# 5. CONCLUSION

The methodologies and descriptions in this report will be used when preparing NEPA documents for renewable energy leasing and projects proposed offshore from North Carolina to Florida. This document is intended to be a living document that will be revised and adapted through its use to include updated information and to incorporate any new activities or effects not currently identified. This report will aid in improving consistency and efficiency amongst NEPA documents for renewable energy leasing and projects.

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

**Bureau of Ocean Energy Management (BOEM)**
The mission of the Bureau of Ocean Energy Management is to manage development of U.S. Outer Continental Shelf energy and mineral resources in an environmentally and economically responsible way.